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ECONOMIC GEOGRAPHY

JULY

FRENCH-SPEAKING FARMERS OF SOUTHERN LOUISIANA
Walter M. Kollmorgen
Robert W. Harrison

ARIDITY OF THE SOUTHERN HEMISPHERE CONTINENTS
Benjamin Moulton

THE INDUSTRIES OF BRISTOL
Frank Walker

EL SALVADOR
Minnie E. Lemaire

NORTH CAROLINA FLATWOODS
Samuel T. Emory

PECAN INDUSTRY IN THE UNITED STATES
Isabel K. Billings

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BAYOU TECHE

BAYOU TECHE, "where it flows through the green Opelousas," has come to symbolize in America a distinct cultural community in which there is more pronounced flavor of the Old World than in most parts of our land, even such sections as the Dakotas with their preponderant Scandinavian stocks, or the Southern Appalachians with their ancestral lineage of Scotch Irish, or the Pennsylvania valleys with their renowned Pennsylvania Dutch. A sentimental savor clings to the land of the Acadians centered upon Bayou Teche, derived from the popular literary attachment of our people to Evangeline and her little village of Grand-Pré, the murmuring pines and hemlocks that rimmed her Acadian homestead, and her faithful search for her lost lover.

The French-speaking farmers of the Bayou country of Louisiana have maintained the sentimental savor of their section by their distinctive adjustments to the land that the bayous distinguish in their place names, in their patois, in their patterns of settlement and farm boundaries, in their songs and dances and conviviality, in their creole cooking and their black coffee, in things culturally both large and small. Against the background of their dark, broad, stagnant streams; dark live oaks hung heavy with Spanish moss; and dark groves of long-leaf and loblolly pine, they have preserved a pleasant way of life and a pattern of culture comparable to none other.

Such names as Calcasieu, Courtableu, Petite Anse, Terrebonne, Grand Ecore, Lafourche and Plaquemine, bear the stamp of Bourbon France and the fleur-de-lis. Baton Rouge, Avoyelles, and Pointe Coupee confirm their French origin. Yet the land of the French-speaking farmers is no longer a political or ethnic island, but purely a cultural island as loyally and intensely American as any part of our land, despite its alien origins.

What a marvelous land America is, to hold within its bounds so distinctive a culture, and claim it one of its own!

ECONOMIC GEOGRAPHY

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FRENCH-SPEAKING FARMERS OF SOUTHERN LOUISIANA

Walter M. Kollmorgen and Robert W. Harrison

THANKS to Longfellow's "Evangeline," the French-speaking inhabitants of southern Louisiana, especially the Acadians, occupy as prominent a place in the folklore of this nation as do the early Puritans of New England. Folklores, however, create rather extravagant pictures, and the stereotypes molded by them have a tendency to linger from generation to generation, particularly if they are frequently retouched by romantic observers and writers. While such retouching has been popular and perhaps worth while with respect to the Acadians —as well as the Puritans, Indians, and other groups—research workers must seek to provide a more realistic picture of folks they deal with because their contributions frequently serve as a basis for action programs involving group welfare.

Aside from Acadian traditions, there are numerous interesting facets to the lives and folkways of the French-speaking people of Louisiana. Prominent among these are the line form of settlements, a nonpuritan agrarian tradition, a rather intimate, stable community life, Creole cooking, and in some places survival of the horse-and-buggy mode of travel. Less well publicized are acute economic problems which beset the people. They center largely in the sugar-cane economy and may be listed as follows: (1) maintaining satisfactory cane and sugar prices, (2) low farm income for small producers, (3) numerous small, inefficient farm units, (4) high rates of tenancy in places, (5) inability of small farmers to make use of large-scale power equipment, and (6) introduction of profitable supplementary crops.

It is not the purpose of this report to examine problems listed, but to make some observations on the geographic setting of the French-speaking people of Louisiana and on certain cultural considerations that have conditioned economic adjustments. Preliminary to the observations, it may prove helpful to many readers to clarify the meaning of such popular and often misused terms as "Acadian," "Cajun," "Creole," and "French-speaking farmers."

It is both misleading and incorrect to refer to the French-speaking people of Louisiana as "French." The first settlers came to southern Louisiana early in the 18th century and since 1803 their destiny has been fully identified with the destiny of our nation albeit the still common usage of the French language. They are therefore American in every sense of the word. They are largely but not fully of French extraction. Other ethnic elements that settled

in the area were absorbed in the culture of the dominant group, including Germans, Spanish, Irish, English, and some other groups. Since all of these groups in time adopted the French language and many French customs, the linguistic designation is the most convenient and the least misleading.

The French-speaking people of Louisiana occupy a triangular area in the southern part of the state. The base of the triangle is the Gulf of Mexico. The left side is formed by a line running from the southwestern corner of the state to the junction of the Red and Mississippi Rivers; and the right side by a straight line from this junction to New Orleans and the Gulf. In this area, it has been estimated, there are nearly 600,000 French-speaking people, representing somewhat less than 50 per cent of the state's white population. Most of them live in line settlements on small farms fronting on bayous and streams.

The Louisiana French include both Acadians, or Cajuns, and Creoles. Historically and traditionally the term "Acadian" is correctly applied to the French-speaking Catholic refugees expelled from Nova Scotia by the English during the 18th century. These refugees scattered to various parts of the world and only a minority reached Louisiana, where they formed a distinct ethnic group. Colloquially the terms "Acadian" and "Cajun" now have status implications and are used in many sections of southern Louisiana to designate folks in socially and economically inferior positions.

The Cajun patois combines French words with words borrowed from Indian, German, Italian, and Spanish sources. This patois, which has not been used as a medium for writing, has been a real barrier between these people and the outside world and has made for social isolation and group cohesion. Geographically, the Acadians are largely concentrated along the bayous west of the lower Mississippi River.

A popular local legend holds that the Acadians are not true French but descendants of an old Christian refugee group which escaped from the Near East (Armenia) during the period of Roman domination, subsequently lived in France for about 15 centuries, and then migrated to the New World. Because of this background, it is pointed out, the Acadian does not reflect the true nor the best in French culture.

While the term "Creole" may be applied to foods and products as well as people, in demographic literature its application is usually limited to immigrants who came to Louisiana prior to the Louisiana Purchase (1803) and their descendants. Some Negroes in the bayou country also refer to themselves as Creoles, presumably because they are the descendants of slaves or servants of Creole families. They usually speak French and in many ways reflect characteristics common to *ante bellum* society. Like the word "Cajun," the term "Creole" now has status implication and connotes more select upper-class groups. (See H. W. Gilmore, "Social Isolation of the French Speaking People of Rural Louisiana," *Social Forces*, Vol. 12 [October 1933], pp. 79–84.) When the term is applied to cooking and products, its implication naturally is one of quality and superiority. In contrast to the Acadians, the Creoles have maintained a strong economic and social position in the plantation economy along the Mississippi River and in New Orleans.

The economic adjustments made by the French-speaking farmers in southern Louisiana cannot be appraised without a knowledge of the geographic setting of the Louisiana bayou country, which

has added a high degree of physical isolation to their linguistic and cultural isolation. It has been said, particularly of the Acadians, that no other agrarian group has been so completely isolated from national agricultural trends and developments.

The change from continent to Gulf in southern Louisiana is rarely clear and distinct. A rather broad belt of marshlands borders the Gulf. These lands rise generally only slightly above mean high water levels. The extent of the exposed land masses is constantly altered by tidal water, occasional hurricane waters and outpouring continental water. Built up on the marsh and swamp lands are the natural levees formed by meandering streams and bayous. These peninsular-like formations are the sites of the famous line settlements long associated with the

FIGURE 1.—In their upper reaches larger bayous in Lafourche and Terrebone Parishes have wide natural levees, which have been largely converted to farm lands. Toward back part of the farms, runoff is slow and sluggish, and gravity ditches are common to expand the area of cultivable land. Note roads and line of settlements along the main bayou. (Courtesy of Agricultural Adjustment Administration, Washington, D. C.)

French in Louisiana. In early days, boats provided the chief means of transportation. On the smaller bayous and streams the small pirogue was used. Roads and railroads were slow to penetrate this country. Near subsistence economies, based on forests, wild life, fish, and agriculture, became common, particularly in the more isolated sections.

While line settlements are well adapted to the natural levees of southern Louisiana, this mode of settlement was also adopted by French settlements in Canada and in the Great Lakes region. This form of settlement is therefore a cultural phenomenon as well as a geographic adaptation to the land forms prevailing in the bayou country of Louisiana. Like the French language and Catholic religion, line settlements and the complex and intimate social life which they engender, have become an integral part of the culture of French Louisiana.

Linguistic, economic, and geographic isolation do not account fully for the group solidarity and place attachment of the French-speaking farmers. These result partly from their abundant social life and strong familial attachments, which have received perhaps as much attention as their line settlements. Propinquity of farm houses in line settlements naturally favors easy and frequent social relationships although the disposition and practice of visiting also rests on various cultural complexes. In few ethnic and cultural groups in this country are family ties more strongly developed and perpetuated than among the French-speaking farmers, especially among the Acadians. A Catholic priest in one of the Acadian communities pointed out that about 40 per cent of the young men who left home to prepare for priesthood returned within a year because of homesickness, and that men drafted for war services left their homes under extreme emotional disturbance. He added that those working in defense centers along the Gulf or in the cities usually return home at least once a month to spend some time in the midst of familiar scenes and faces. Considerations such as these must be kept in mind to understand some of the problems with which these people are faced.

The remarkable place and folk attachment of the French-speaking people of southern Louisiana resulting in their place stability has been an important factor conditioning their economy. Most of the lands they occupy were taken over and developed within about a century after their coming to this continent. Since then there has been mainly a pyramiding of people on available local lands rather than a striking out for new lands lying to the west, north, and east. Neither in Louisiana nor in Canada did the French demonstrate an aggressive pioneering quality. A question along this line in southern Louisiana brought the reply that the Frenchman is a family man and not a Daniel Boone. Even nearby Texas, which was developed almost entirely during the last century, was ignored by these people, although their holdings have been small for several generations. In recent decades and in the World War II period, a good many of these people have moved to nearby urban areas, particularly New Orleans, Baton Rouge, and Alexandria, and some have gone as far west as Port Arthur and Houston. In general, this movement was circumscribed to nearby cities and coastal areas so that members of families could keep in close touch with each other. The French-speaking people, unlike the Okies, have not sought out the far horizons of California, nor have they, like the Negro and the Appalachian hill farmer, sought out factory centers of the North. In most instances their education is rather lim-

ited and few of them possess special skills. Those who have migrated to nearby cities usually engage in common labor, become domestics, or work in service establishments.

The failure of the French-speaking people to pioneer in new land developments and new forms of agriculture is especially striking in view of the fact that few states in this nation have engaged in more persistent land-promotion and land-settlement programs than the State of Louisiana. Since the days of Reconstruction, state publications describing farming opportunities in the state have been issued to invite farmer immigrants. This effort has been duplicated by railroads, real estate firms, and chambers of commerce. By direct statement and by implication, most of this literature has been directed to out-of-state people. Little attention has been given to a possible redistribution of farmers already in the state.

Land promotion literature as well as numerous interviews in the state make it clear that most of these agencies do not view the small farmer of southern or northern Louisiana as particularly promising new-ground farmers, particularly for high-priced reclaimed lands or lands which are suitable for machine farming. Lack of experience, managerial ability, capital, and efficient work habits are cited as handicaps characterizing these small farmers. Some of the most concentrated efforts to attract immigrants have been directed to the grain and stock farmers of the Great Plains and Corn Belt. Thousands of these responded. They converted the prairies in the southwestern part of the state

FIGURE 2.—Near the Gulf of Mexico, natural levees decline in width and elevation and give way to marshlands interspersed with bodies of water. As this picture suggests, the natural levees were formerly covered with forests. (Courtesy of Davis Aerial Photographic Service, Houma, La.)

into a flourishing rice-producing area. These prairie lands reach from bayou to bayou and therefore adjoin the land long occupied by the French-speaking people. Here millions of acres—land immediately adjacent to the French-speaking farmers—were brought under the plow during the last 60 years; yet this development did not to a measurable degree relieve the land pressure in the line settlements. During the same period a considerable colony of Italian immigrants was established in Tangipahoa Parish (north of Lake Pontchartrain); in the same parish is Hammond, at one time known as an important Yankee town in the deep South. The Italians and the Yankees were brought to this section by promotional literature extolling the productivity of the land in the parish, particularly for the production of strawberries and early vegetables. Here, as in the rice area, immigrants were brought to the state to develop new lands.

Agricultural lands in Louisiana can be greatly expanded and further development is considered necessary and imminent, although there is as yet no agreement on who should develop and occupy these lands. The hope that immigrants from outside the state can be attracted is quite widespread, particularly among private promotional agencies. Corn Belt and Grain Belt farmers, such as came to southwestern Louisiana, are desired, as well as thrifty peasant groups with a north-European background. If a redistribution of the population within the state is to be effected, participation in such a program by the Federal Government may well be necessary.

The largest blocks of undeveloped land in Louisiana lie in the northeastern part of the state along the Mississippi and Ouachita Rivers and in the marshlands along the Gulf. Each section has its advocates and champions. In both sections development costs will be high, as past experience has demonstrated, and it is becoming increasingly clear that if large reclamation projects are undertaken they will need to be subsidized by the Federal Government.

Since a choice is possible in selecting one or the other of the above-mentioned areas for concentrated development, the question was put to a number of informants in south Louisiana if they would care to move to newly developed alluvial lands in northeast Louisiana if a major reclamation project is carried out there. The answers were all in the negative. Said one informant: "North Louisiana belongs to the people in the northern part of the state and south Louisiana belongs to us. They wouldn't like to see us come up there and we don't like to see them come down here. We are cane growers and they are cotton growers." This opinion on the dichotomy of the state is significant and has complex ramifications. What the informant did not mention but recognized fully is equally as important as what he did way. North Louisiana in its rural sections is dominated by a people who speak the English language and have a Protestant puritan agrarian tradition; south Louisiana in its rural sections is dominated by a people who speak the French language and have a Catholic, nonpuritan agrarian tradition. The two groups view each other with some misgivings—a fact well highlighted by the political history of the state.

The marshlands along the Gulf, if developed for agricultural purposes, are well located for occupancy by the French-speaking farmers. In fact, the plight of many of these people has served to arouse much current interest in developing these lands under Government auspices. Proposals for the

reclamation of marshlands in southern Louisiana are not new. Reports proposing such developments date back over one hundred years, although it was not until the early decades of this century that several scores of projects were developed. From 1910 to 1930 the U. S. Department of Agriculture made several studies of these projects, particularly from an engineering point of view. The reports are highly encouraging and no doubt played an important part in initiating a number of developments. However, of the several scores of large reclamations all but two are again under water. These, it is reported, have at times required considerable subsidy to continue operation. Although early promoters held that the reclaimed marshlands could produce "nearly everything" and would no doubt become thriving truck farming centers, the two remaining ones are planted almost entirely to corn.

Reclamation of the marshlands for agricultural purposes will be a difficult and costly undertaking. An elaborate system of dykes and ditches associated with pumping systems must be provided. Crops more remunerative than corn must be produced to meet the high costs of development. Moreover, according to one informant who has participated in marshland reclamation, hard-working farm families with experience in producing specialty crops must be found to take over these lands if the venture is to be successful. Even if the above problems are met, others remain. Earth compaction and physical alteration of the soil-forming material due to drainage and cultivation create special problems for which no ready solutions are at hand. Apparently large scale reclamation projects in these marshlands should be deferred until more is known about reclaiming and developing them.

If the marshlands are to be developed for agricultural purposes and settled by small French farmers, the administrators must be prepared to subsidize not only the development of the land but also a sustained farmer-training program. Small farmers must be converted into efficient producers using complex machines and approved agronomic techniques. This transformation, it has been learned elsewhere, may be as costly as the reclamation of the land itself. With postwar agricultural surpluses staring us in the face, as well as the present and prospective need for great quantities of more complex goods and services, it may well prove less expensive and more profitable to society generally to relieve the economic plight of the Louisiana French by aid and encouragement toward nonfarm employment. There is much evidence to show that rural youths can be trained more readily and more economically to become efficient producers in manufacturing plants and in various services than they can be trained to become efficient farmers. In a farm-training program folkways usually linger and these may well include inefficient, non-approved techniques. In a shift from farming to nonfarming activities, such folkways find little application in production and hence present no special problem.

Postwar planners working with the French-speaking farmers of southern Louisiana must remember that many of the economic problems faced by these people are not of recent origin but date back one or more generations. Moreover, many of the situations which planners and outsiders may view as problems are not recognized locally as such. Careful inquiry among these people, including county officials, showed little awareness of the present and coming problems associated with the small, inefficient farms yielding little

besides a subsistence living. Few suggestions, plausible or otherwise, were gathered locally with regard to increasing the economic base either by developing new lands or by expanding industries. Boys in the service are confidently expected to return to their home communities and to remain there. While it is not clear what many of them will do for a living, informants were not worried by this since hard times have been weathered before. Such nonchalance, it appears, should temper over-ambitious or hasty programs designed to sweep all of these people into the fast and rather perilous stream of highly commercialized and competitive agriculture.

ARIDITY OF THE SOUTHERN HEMISPHERE CONTINENTS

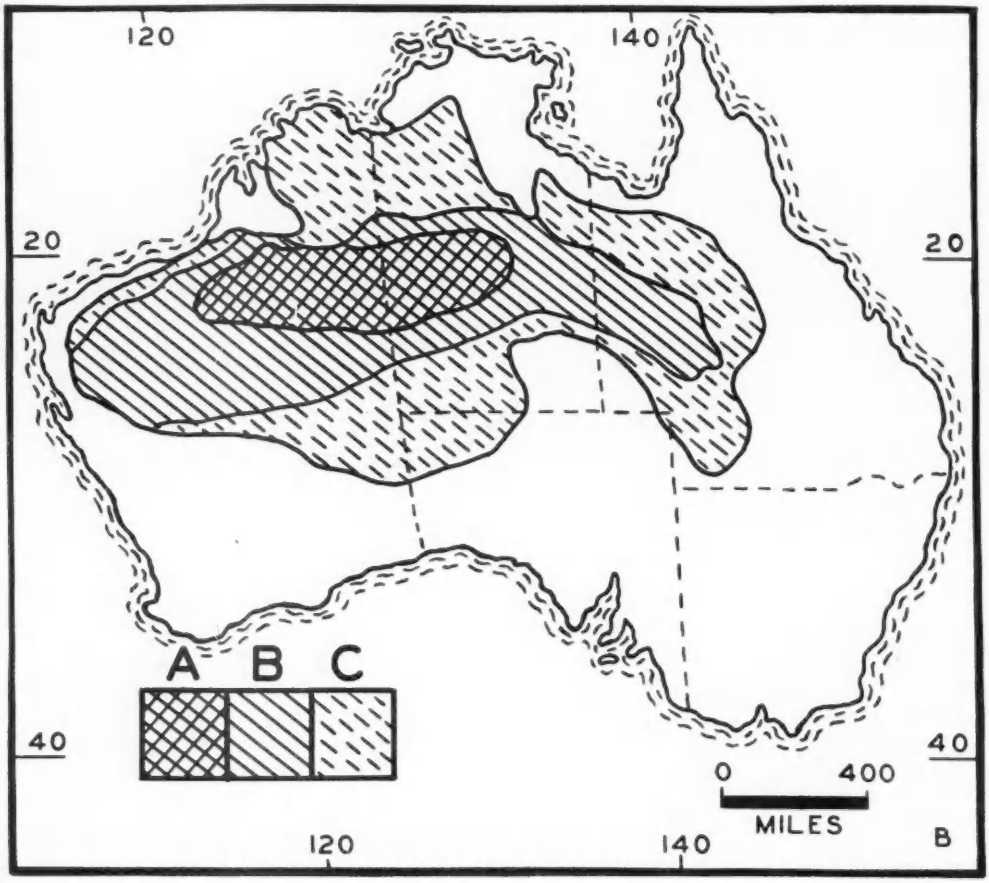
Benjamin Moulton

THE maps of this article present distribution and duration of the major dry climatic types of Africa, Australia and South America. The source material was derived from Army Climate Zones Maps compiled by the Climatology Unit, Research and Development Branch of the Office of the Quartermaster General and issued in 1943. Since any extended period of dry climate leaves its mark in the natural vegetation of the region it is desirable that man recognize the presence and extent of such normal drouth periods, for recognition facilitates wise land use.

Maps 1 and 2 show very hot and dry climatic types, i.e., the average monthly temperature is above 86° F. and precipitation is less than 4″ per month (South America does not experience this climatic type). In Australia most of the type is confined to the sandy interior wastes at elevations of one to two thousand feet. Maximum duration period is four months in an area of about 150,000 square miles, with an area about twice as large having at least two continuously very hot and dry months. About a quarter of the Australian continent is very hot and dry at least one month. In Africa (Map 2) the very hot and dry climatic type is found only north of the equator. There, seven areas are very hot and dry for as much as five months, and all are below two thousand feet in elevation. A larger area is very hot and dry for four months, along the Red Sea Coast, the Gulf of Aden and a large portion of the Sahara. June is very hot and dry over the largest area. Except the periphery, nearly all of Africa north of 10° N. L. is very hot and dry for at least two months.

The very hot and dry areas of Australia and Africa are not very productive. Under unusual hydrological conditions and artificial irrigation, small portions become of economic importance in agriculture. Dates, palm oil, and ground nuts make up dominant crops. Small numbers of sheep, goats and cattle are raised in the areas of two months or less of this climatic type. Tropical vegetation varies from the intense areas of desert, to xerophytic scrub, to the Savanna type. Population, as a consequence, is sparse and predominantly less than one person per square mile.

Areas that are hot and dry (average monthly temperature 68–86° F., precipitation under 3″) are extensive in South America as well as in Africa and Australia. In Australia (Map 3) the maximum duration is seven months in the four black areas, all of which are below a thousand feet in elevation. Areas adjacent and the entire area of Arnhemland are hot and dry at least one-fourth of the year. Exceptions are the east coast, the southeast coast, the southwest coast and higher elevations of the interior. Africa (Map 4) has one large area and two small areas that are hot and dry throughout the year, of which the largest is in the lowlands of East African Somalia. The areas hot and dry for seven to eleven months extend almost across the continent along latitudes 13°–14° N., and also along the coast of Mozambique

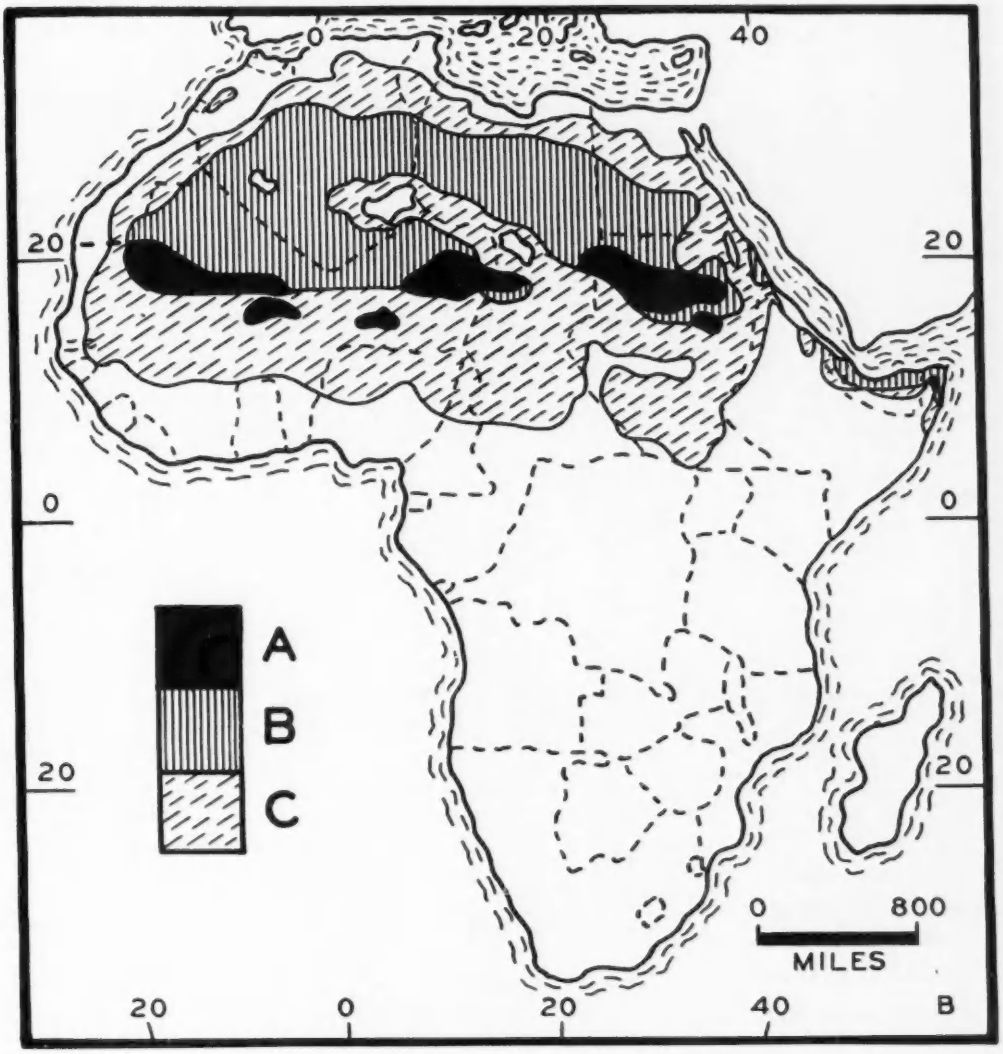


MAP 1.—Australia—Very Hot and Dry
A. Areas continuously very hot and dry four months.
B. Areas continuously very hot and dry two or three months.
C. Areas continuously very hot and dry one month.
Average monthly temperature 86° F. or over; precipitation under 4″ per month.

and northwards to Kenya. Areas that have from three to six months of high temperatures and aridity, the third classification shown on Map 4, are numerous and widespread. Extent and duration of a hot and dry climatic type in South America is shown by Map 5. The maximum duration period, nine months, is experienced in four small areas—in the extreme north and south of Guayaquil in Ecuador. Large areas in the Campos and the Matto Grosso endure this climatic type five to eight months. About a quarter of the continent has a hot and dry climatic type three or four months. Almost one-half of South America has one or two months that are very hot and dry. Even much of the Amazon Basin, despite its reputation for continuous rainfall, is hot and dry for two months or longer.

The hot and dry conditions indicated on the three maps just reviewed again appear to represent critical conditions which, along with other factors, are in a large measure responsible for the type of vegetation and the land use in the areas.

In general, all areas have either xerophytic or mesophytic vegetation

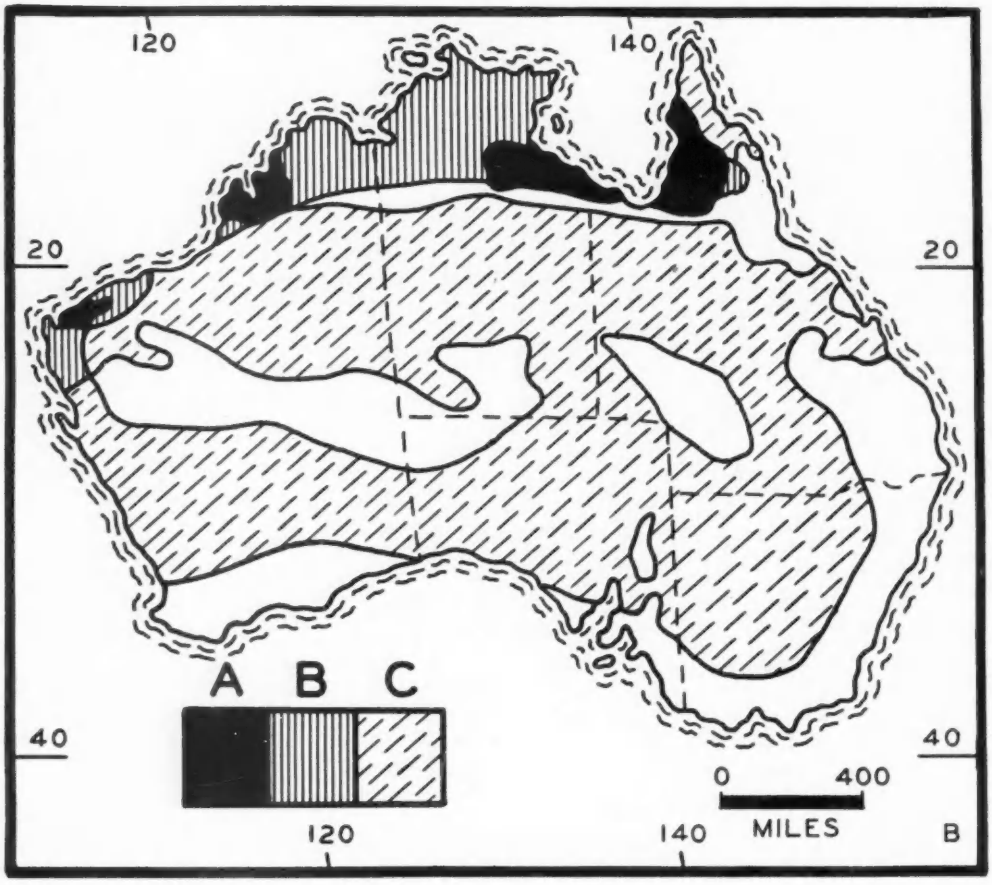


MAP 2.—Africa—Very Hot and Dry
A. Areas continuously very hot and dry five months.
B. Areas continuously very hot and dry four months.
C. Areas continuously very hot and dry two to three months.
Average monthly temperature 88° F. or over; precipitation under 4″ per month.

with exception of rice grown in irrigated areas of South America and Africa. Although rice here is of importance in local food consumption, it is an insignificant crop in world trade.

On the poleward margin of the areas, vegetation would normally be more prolific. On the equatorward margins, areas would merge into Tropical Rain Forest or Savanna lands. In low latitudes, the dry season of the Savanna lands are represented by this climatic type. In middle latitudes, cereals, especially barley, wheat and corn, are grown. Tobacco is cultivated in small quantities while dates, palm oil, and cane sugar are raised by irrigation only. Some hogs, sheep, goats and camels are also raised.

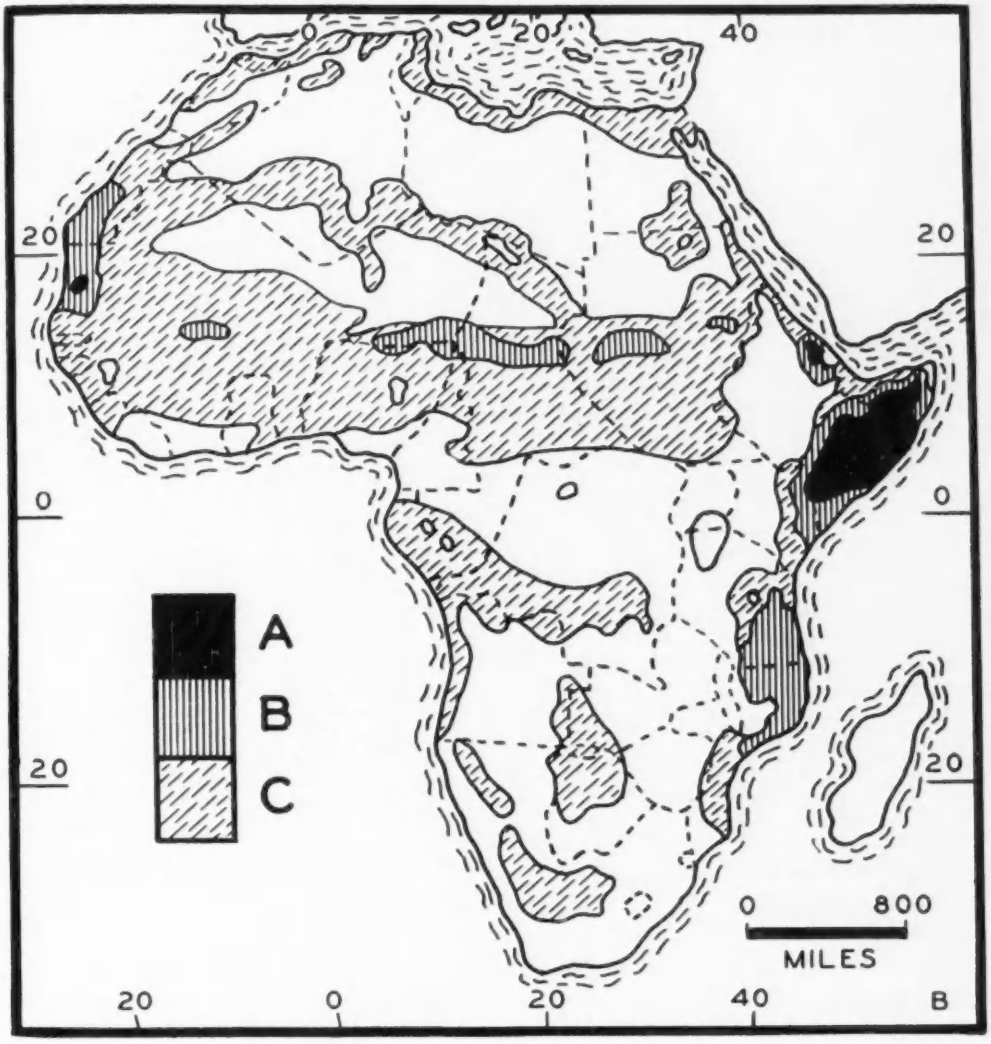
Any survey of the maps, however, in



MAP 3.—Australia—Hot and Dry
A. Areas continuously hot and dry seven months.
B. Areas continuously hot and dry five to six months.
C. Areas continuously hot and dry three to four months.
Average monthly temperature 68°–86° F.; precipitation under 3″ per month.

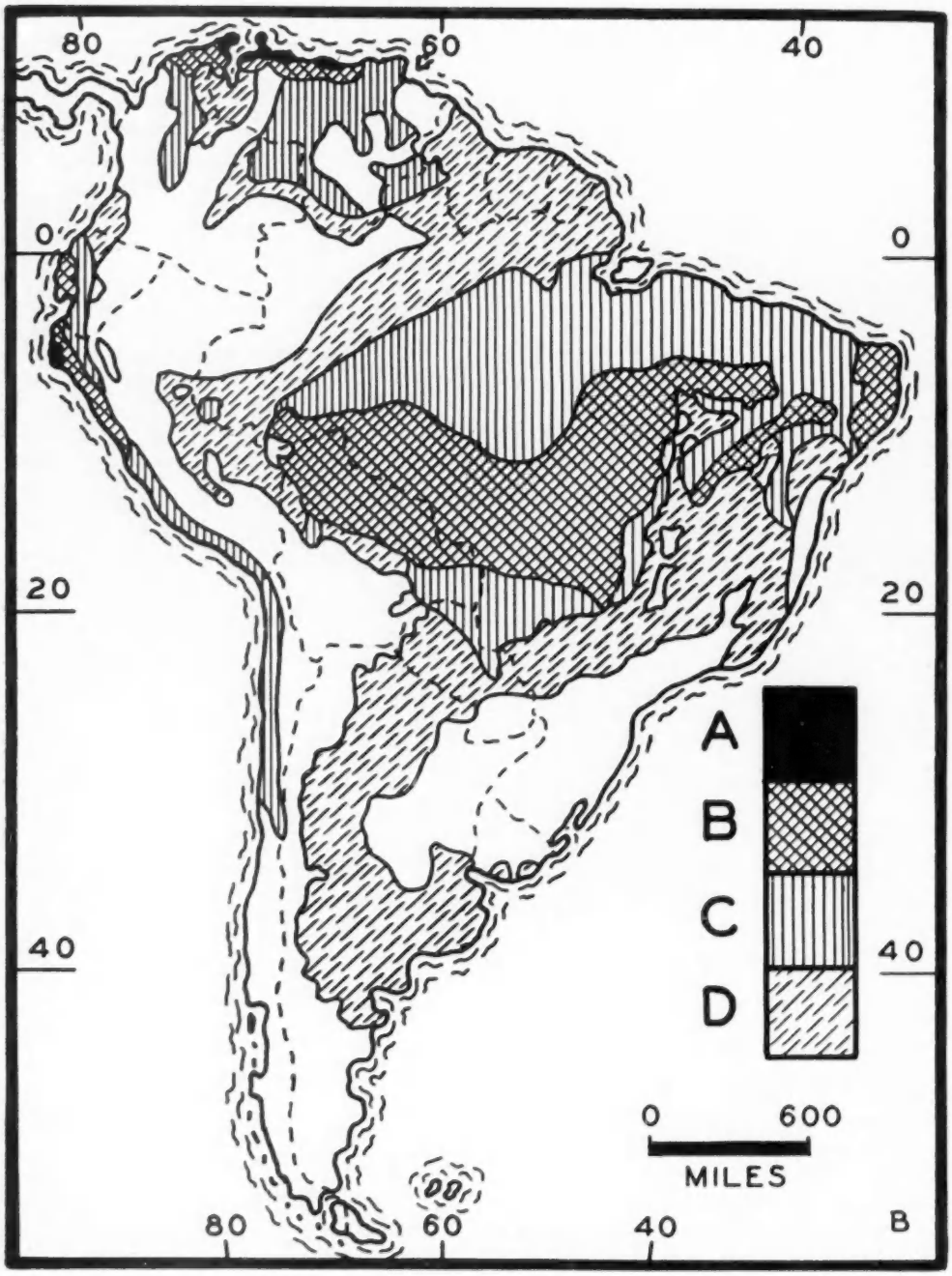
comparison to the maps showing distribution of population and tropical or subtropical forest products will show that they are not important from those standpoints. Such statement is particularly true of areas experiencing, normally, five or more months of the climatic type.

The next three maps, 6, 7 and 8, show distribution of the warm and dry climatic type (average monthly temperature 50°–68° F. and precipitation less than 2″ per month). Nearly all of Australia (Map 6) south of the twentieth parallel has at least three warm and dry months. A maximum duration of seven months prevails just to the northwest of the Nullarbor Plain. Nearly a third of the continent is warm and dry for at least five months. In Africa (Map 7) only two small areas are warm and dry for more than seven months and one area, the littoral desert of Southwest Africa, is warm and dry throughout the year. An adjacent area of like size, and another of comparable size in Northwestern Africa display like climatic conditions seven to eleven months. A much larger area, including the Kalahari Desert, is warm and dry



MAP 4.—Africa—Hot and Dry
A. Areas hot and dry throughout the year.
B. Areas continuously hot and dry seven to eleven months.
C. Areas continuously hot and dry three to six months.
Average monthly temperature 68°–86° F.; precipitation under 3″ per month.

five or six months. Large areas in northern Africa and elevations above five thousand feet in the Doldrums have this climatic type three or four months of the year. In South America (Map 8) warm and dry conditions persist throughout the year in three tiny areas in the same latitude as similar areas in Africa, but they lie slightly inland behind the Pacific coastal range. Slight enlargement of areas on this dry western coast and on the dry portions of the eastern side of the mountains indicates areas that are warm and dry seven to eleven months. Areas that are warm and dry for three to six months are much larger and include most of Patagonia, the Brazilian Highlands, the Guiana Highlands, and the Grand Chaco.



MAP 5.—South America—Hot and Dry

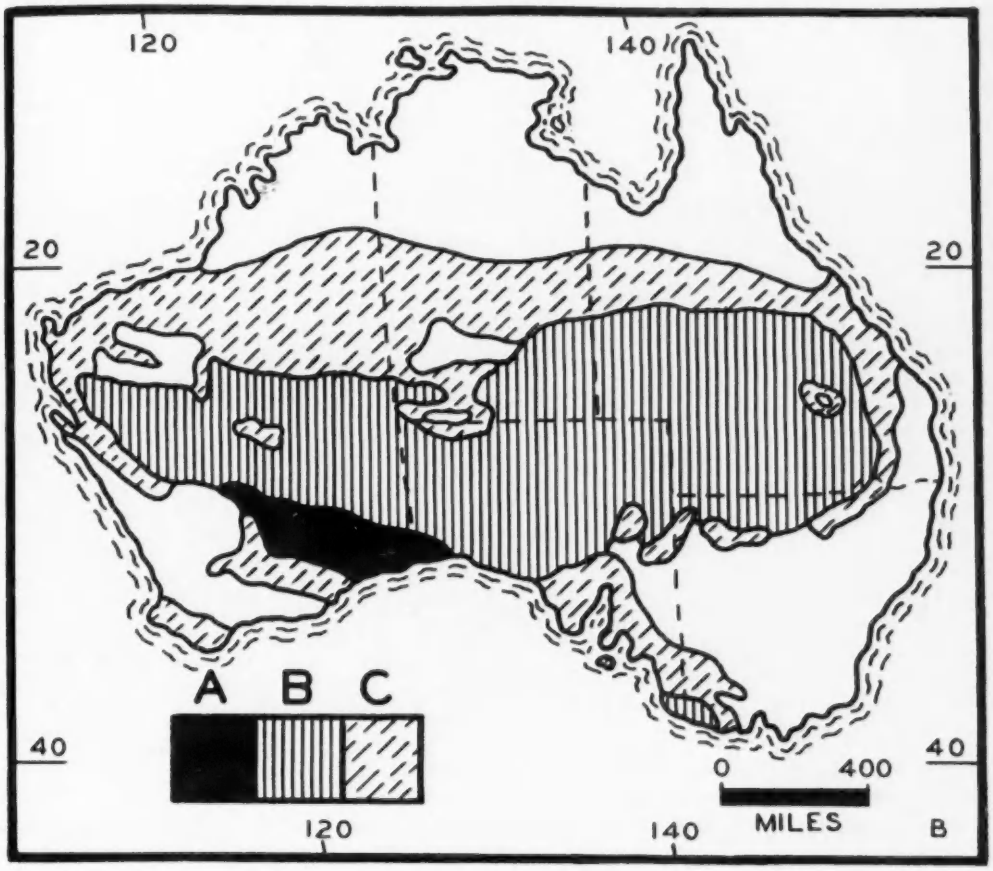
A. Areas continuously hot and dry nine months.

B. Areas continuously hot and dry five to eight months.

C. Areas continuously hot and dry three or four months.

D. Areas continuously hot and dry one or two months.

Average monthly temperature 68°–86° F.; precipitation under 3″ per month.



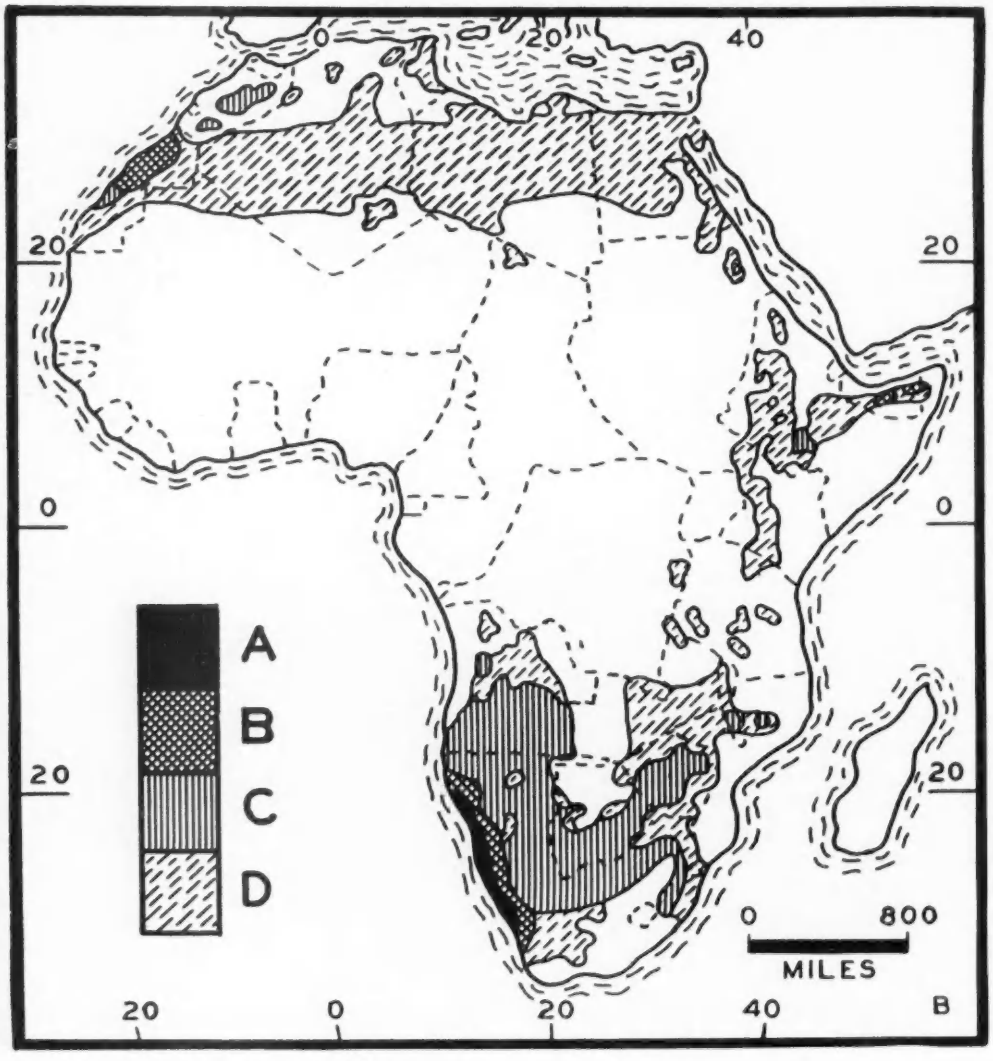
MAP 6.—Australia—Warm and Dry
A. Areas continuously warm and dry seven months.
B. Areas continuously warm and dry five or six months.
C. Areas continuously warm and dry three or four months.
Average monthly temperature 50°–68° F.; precipitation under 2" per month.

Areas indicated on these maps as subject to the warm and dry climate seven to eleven months are areas of sparse population and of well-known deserts. They rarely get cooler but in the summer season usually are considerably warmer with exception of Southwest Africa and south of 18° South Latitude in South America, which are usually mild the year round.

Advantageous irrigation facilities make possible variety of crops in the South American area. Local conditions, under control of a combination of physiographic features, permits grazing of sheep, goats and other forms of nomadic and sedentary herding.

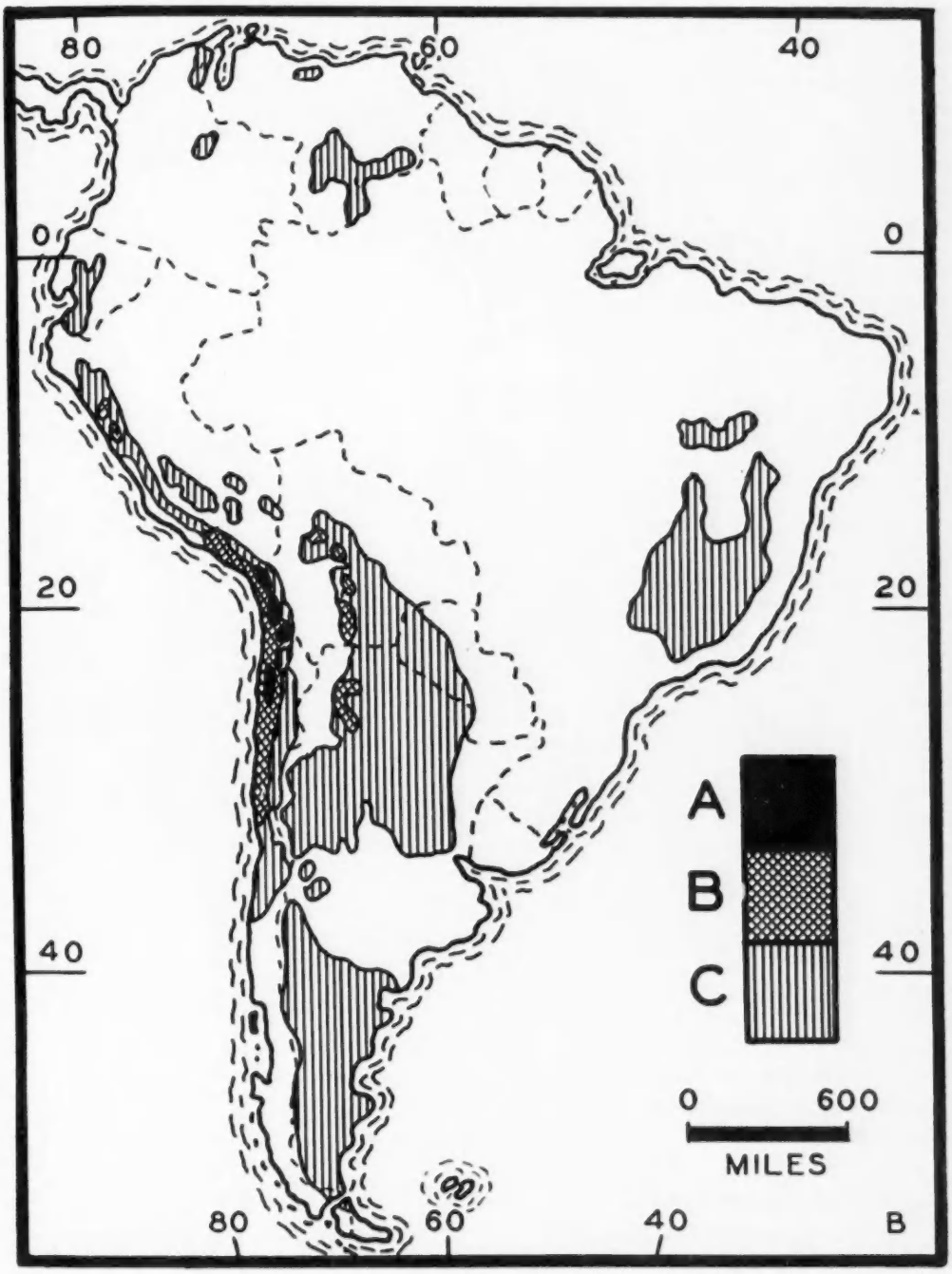
Minerals in Africa (Vanadium ores) and South America (Nitrates) are sources of income for some people in the areas.

Regions sharing such a climatic regime for six or less months per year are widespread and alternate primarily with other dry climatic types either warmer or cooler. Thus, they are actually represented on maps, by far and large, as areas of grazing. A few exceptions, of course, are the Mediterranean type regions of Chile and Southwest Australia and others.



MAP 7.—Africa—Warm and Dry
A. Areas warm and dry throughout the year.
B. Areas continuously warm and dry seven to eleven months.
C. Areas continuously warm and dry five or six months.
D. Areas continuously warm and dry three or four months.
Average monthly temperature 50°–68° F.; precipitation under 2″ per month.

Maps 9, 10 and 11 indicate distribution and duration of dry climates. About one-half of Australia (Map 9) is continuously dry and four-fifths of Australia is dry for more than half the year. Only small areas are considered as normally never experiencing a dry climatic regime for as much as a month's duration. In Africa (Map 10) three areas, about one-fifth of the continent, are normally dry throughout the year, predominantly in the Sahara region where there is a belt ten degrees of latitude in width extending from the Atlantic to the Red Sea. Another area is in East African Somalia and the third area is in southwestern Africa. Over one-half of the continent is dry



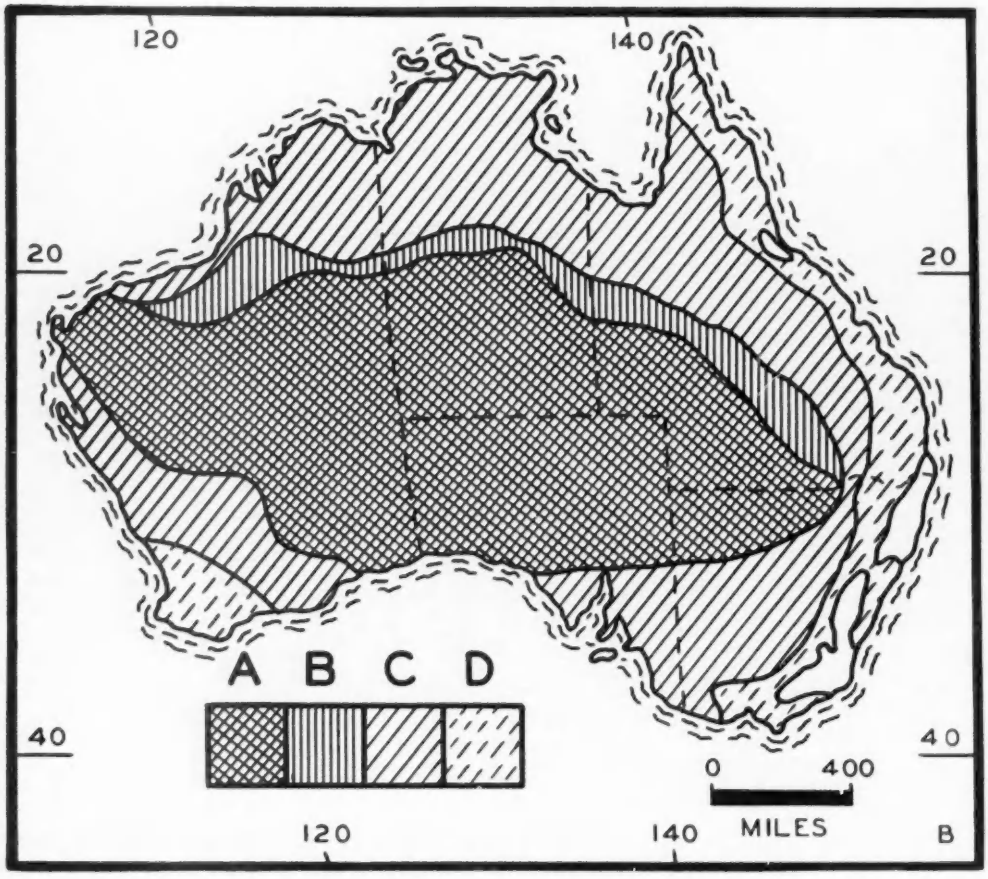
MAP 8.—South America—Warm and Dry

A. Areas warm and dry throughout the year.

B. Areas continuously warm and dry seven to eleven months.

C. Areas continuously warm and dry three to six months.

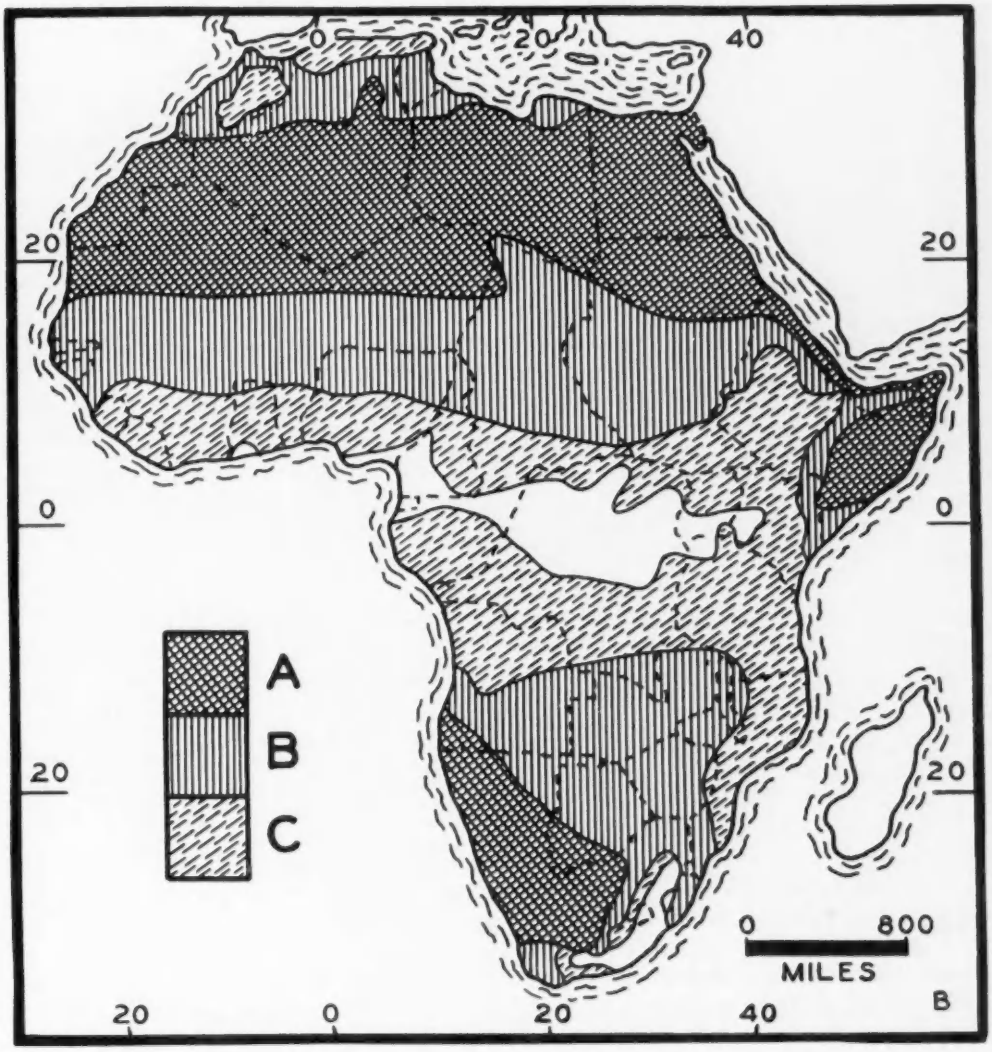
Average monthly temperature 50°–68° F.; precipitation under 2″ per month.



MAP 9.—Australia—Dry
A. Areas continuously dry throughout the year.
B. Areas continuously dry nine to eleven months.
C. Areas continuously dry five to eight months.
D. Areas dry one to four months.
E. Unshaded areas not normally dry for a month.

from seven to eight months of the year. Nearly nine-tenths of Africa is dry at least three months each normal year. The one-tenth normally not dry so long is the Atlas Mountains, the Drakensberg Mountains and the Doldrum areas along the equator. Relatively little of South America (Map 11) is dry throughout the year. The larger areas continuously dry are the narrow belt along the western coast from latitudes 6° S. to 31° S. and the eastern margin of Patagonia from the Rio Colorado south to Puerto Santa Cruz. Smaller areas are found in west Central Argentina and at the continent's northern extremity. Nearly a third of South America is dry five or six months, much of the Grand Chaco, the Campos, the Brazilian Highlands and about half of the Pampas. Seven-eighths of South America is dry for at least one month a year.

In the composite map of all dry climatic types as represented on the three maps just reviewed (Maps 9, 10 and 11), certain areas on these maps must be recognized as areas of intensive production, the Mediterranean type regions of Africa, Chile and Australia

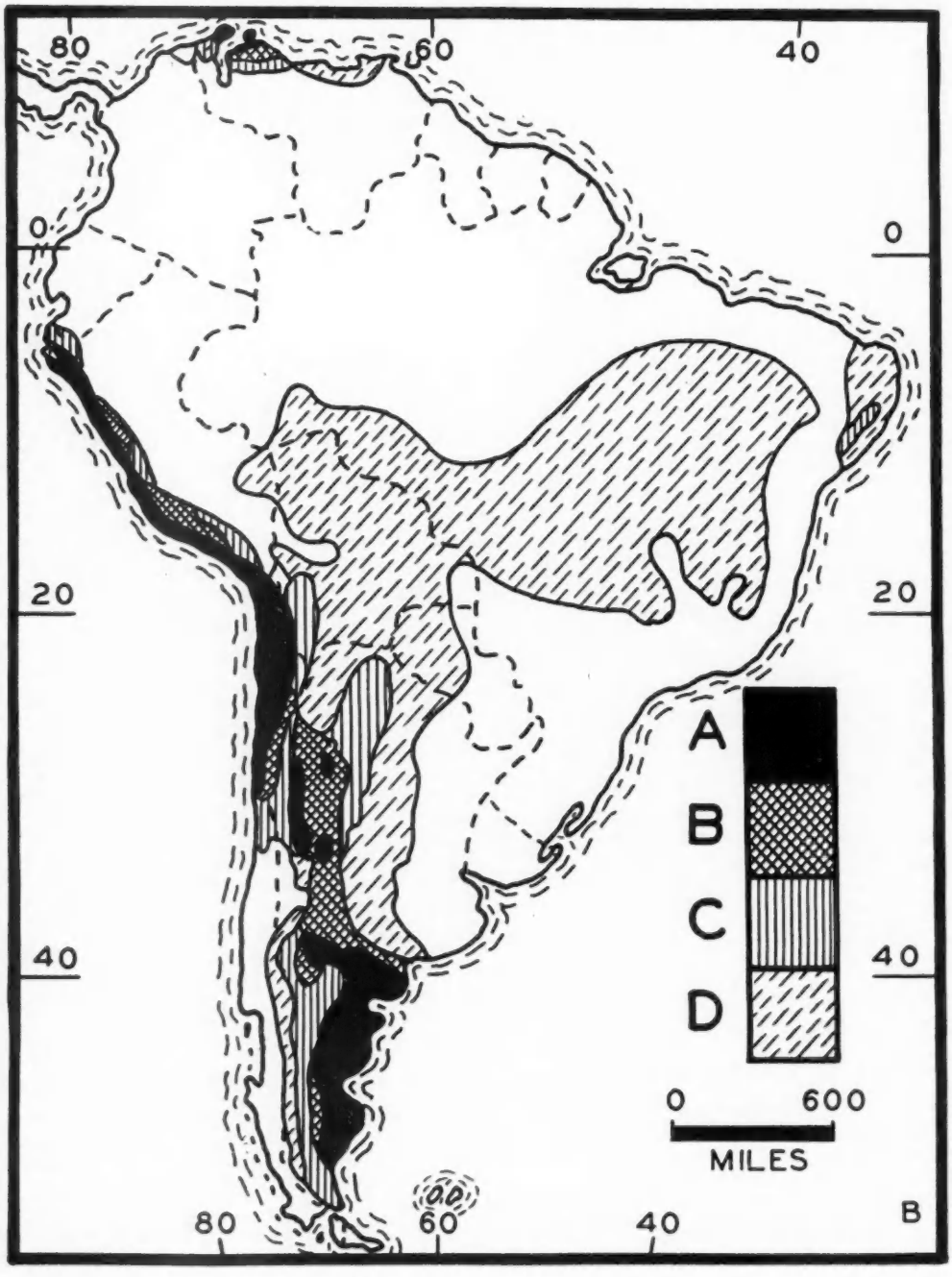


MAP 10.—Africa—Dry
A. Areas dry throughout the year.
B. Areas continuously dry five to eleven months.
C. Areas continuously dry three or four months.

included. Therefore, it is not feasible to imply that it is disadvantageous for any area to have a dry climatic type for a considerable length of time. Many forms of agriculture require an arid or semi-arid period, such as, coffee, sugar, grapes, cotton, and a score of others.

SUMMARY

The table affords a summary of the climatic information contained on the maps. In brief, about one-fifth of Africa is dry throughout the year as compared to one-half of Australia and one-fiftieth of South America (South America is not subject to the very hot and dry climatic type, whereas in Africa this climatic type is endured in many areas as long as six months). Hot and dry conditions prevail for about half the year or longer in about one-third



MAP 11.—South America—Dry

A. Areas dry throughout the year.
B. Areas continuously dry nine to eleven months.
C. Areas continuously dry seven to eight months.
D. Areas continuously dry five or six months.

TABLE I

APPROXIMATE PROPORTION OF CONTINENTAL AREA IN EACH CLIMATIC TYPE

Duration in Months	*Climatic Type and Continents*											
	Dry			*Very Hot and Dry*			*Hot and Dry*			*Warm and Dry*		
	Africa	*Austr.*	*S.A.*	*Africa*	*Austr.*	*S.A.*	*Africa*	*Austr.*	*S.A.*	*Africa*	*Austr.*	*S.A.*
12	1/5	1/2	1/50	0	0	None	1/25	0	0	1/50	0	1/300
9–11	5/8	1/2	1/40	0	0	"	1/20	0	1/200	1/25	0	1/200
7–8		4/15	1/35	0	0	"		1/25	1/10		1/30	
5–6		9/10	1/3	1/25	0	"	1/4	1/10		1/15	1/4	1/8
3–4	7/8	19/20	7/8	1/3	1/20	"		8/10	1/4	1/10	1/2	
1–2	9/10				1/4	"	8/10	19/20	1/2	1/5	4/6	1/6

of Africa, in about one-sixth of Australia and in one-tenth of South America.

The geographer is interested in the critical effect of such dry periods upon the natural vegetation and agriculture. The presence of any of these dry climatic types for a month or more require marked adjustment by the vegetation. The amount of adjustment is, of course, also dependent upon temperature, and apparently three months of a warm and dry climatic type does not have so much influence on vegetation as a single month of very hot and dry conditions, with temperatures averaging above 86° F.

THE INDUSTRIES OF BRISTOL

F. Walker

THE industrial life and development of the city of Bristol and the area immediately surrounding it is very closely linked with its function as a port, and the link of cause and effect is a two-way one. Many aspects of industry in Bristol arise from handling and processing commodities which dominate the trade of the port, whilst on the other hand many of the peculiar features of the trade of the port itself arise from the specialised industrial character of its immediate hinterland. Moreover industries of Bristol share with the port the relatively prosperous recent history which distinguishes it from the less fortunate areas of Britain, and here too there are common causes.

Perhaps the most important single fact about industrial development of the Bristol region has been complete absence of what might be termed a staple or dominant heavy industry, though it will be seen later that there has been recent tendency for the aircraft industry to become almost a staple industry especially under the stimulus of war conditions. To the absence of heavy industry in the Bristol region itself must be added the fact that the surrounding Western counties of Somerset, Gloucestershire, Wiltshire, Devon and Cornwall form an essentially rural and agricultural region with only local and small centres of light industry, so that Bristol, even in its larger hinterland, has no industrial area comparable with those served by Liverpool and Glasgow, for example. In consequence Bristol has not taken part in large scale import of industrial raw materials or great export of manufactured articles which has characterised other Western seaports, but has a completely unbalanced import trade in consumer materials. (See "The Port of Bristol," ECONOMIC GEOGRAPHY, 1939, Vol. XV, No. 2.)

Manufacture of tobacco and chocolate and other cocoa products have been most widely known of Bristol's industries and they have so much in common that they may perhaps be considered together first. Clearly both are industries which have originated and developed from processing two of Bristol's oldest imports, tobacco and cocoa beans. Tobacco has naturally figured in Bristol's imports since the 17th century, when the city was Britain's chief port for the American trade, and cocoa beans have been imported through Bristol since they were first introduced into the country when Bristol was playing so prominent a part in development of our trade with the West Indies and Central America. The industries, therefore, originated at a time when all cargoes coming to Bristol were landed at quays in the portion of the Avon which now forms the City Docks and in consequence are industries which belong to Bristol itself and grew up in the centre of the city. The tobacco industry still remains in the centre of the city and in Bedminster where the Bonded warehouses and factories of Messrs. W. D. & H. O. Wills are situated; this one firm has now come to control practically the whole of the industry and to employ almost all of the industry's 6,700 workers, there being only two other firms of any size in the city. Much of the tobacco is now landed at Avonmouth, of course, since the outport

handles most of the trade with America and the tobacco-producing areas of the Empire. It is then brought by barge up the Avon or by road along the Portway to the warehouses in the city, but as the value of tobacco is very high in relation to its weight and bulk, the extra transport is not a serious problem and there has been no move of the industry towards the outport.

Manufacture of cocoa and chocolate, which certainly dates back to 1730, is not concentrated in the hands of one firm quite so completely as that of tobacco, and though Messrs. J. S. Fry employ well over 4,000 of approximately 6,000 employees normally engaged in the work, there are four other quite large firms in the area. Messrs. Fry's works were, until recently, situated in the city itself, where the firm had made its goods since the middle of the 18th century, but they have now transferred to a modern country factory at Keynsham some miles up the Avon. Other firms are also located in the city or on the landward outskirts of the city, so that here too there is no tendency for the industry to move towards the point of arrival of the beans at Avonmouth, rather the reverse. The beans are transhipped at Avonmouth and brought by rail to Keynsham.

In both industries Bristol has been remarkably fortunate that manufactures with such a long history have nevertheless continued to grow in importance throughout the whole of the history and seem likely to continue their growth. Both products are consumer goods and virtually luxury articles, produced almost entirely for the home market. In the past the demand has grown steadily, irrespective of the state of

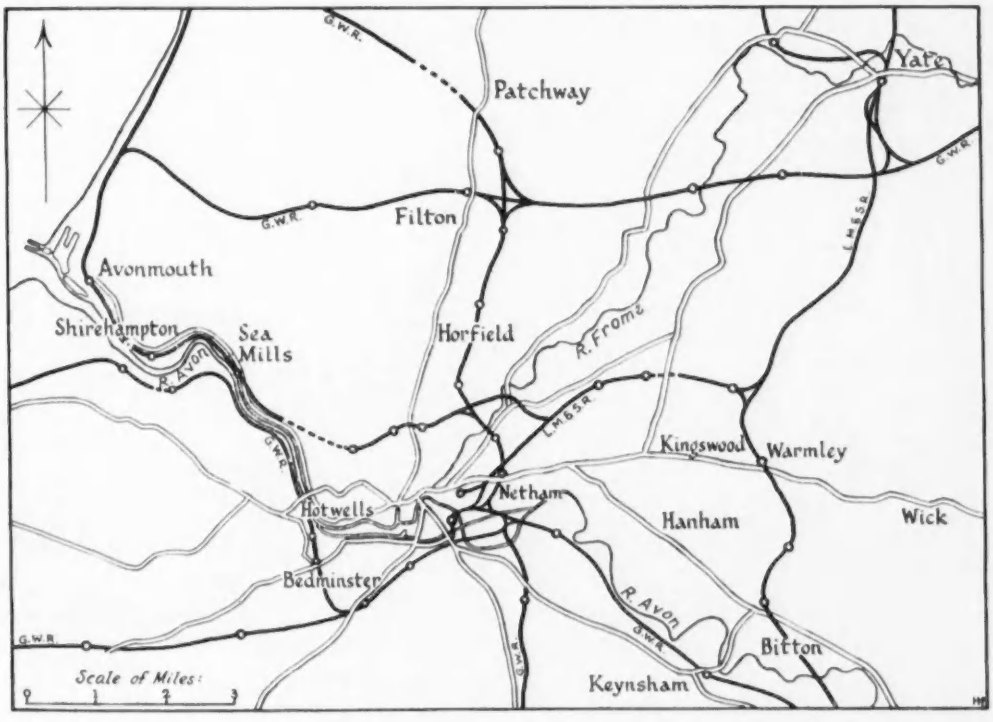


FIGURE 1.—The Port of Bristol, with its districts and suburbs, its river mouth and stream and railway network, all closely related in industrial development and activity, comprises a distinctive coastal conurbation.

prosperity or depression of industry and trade generally. Even during the war demand for tobacco has grown so rapidly that despite the deliberate policy of reducing level of production of consumer goods in general, the level of production of tobacco and cigarettes has been maintained or increased. Similarly, in spite of rationing, production of chocolate and cocoa has been maintained during the war, partly to meet civilian demands and needs of the services, and later to supply chocolate as emergency food for Europe. The growing heavy demand for chocolate before the war will probably continue in the future, especially with the more general realisation of the high food value of the commodity.

FIGURE 2.—Cocoa and chocolate factory near Keynsham. The manufacture of cocoa and chocolate dates back to at least 1730, and now employs 6,000 persons, of whom 4,000 work in a single plant, the modern factory illustrated by this photograph, which was taken some miles up the Avon. (Courtesy of Messrs. J. & S. Fry, Ltd.)

The sugar required for the chocolate industry is also handled by the Port of Bristol which normally imports some 10,000 tons annually direct from overseas and 20,000 tons coastwise, a proportion of which also forms basis for allied manufacture of sugar confectionery. There are six firms of sugar boilers and boiled-sweet manufacturers in the city.

Apart from manufacture of tobacco and chocolate, the most famous of the older, and what may be termed the traditional, industries of Bristol is formed by the large group of occupations based on local manufacture of paper which between them employ well over 11,000 workers within the city itself as well as considerable numbers in the immediately surrounding areas of Somerset and Gloucestershire. It is unlikely that anything but the poorest and coarsest paper was manufactured in Bristol or elsewhere in Britain before 1690, but afterwards Bristol rapidly came to the forefront in this trade. Closely associated with development of the paper manufacturing trade was growth of printing in Bristol, the first printing being done in the city on a mobile press during the Civil War in 1643 and the first permanent press being set up in Bristol in 1695, so that the two industries have grown up more or less contemporaneously. In its origins the industry was of course based on local materials but during most of its recent history it has depended on materials imported through the city docks or brought by barge from Avonmouth. During the war the volume of imports has had to be cut and home-produced

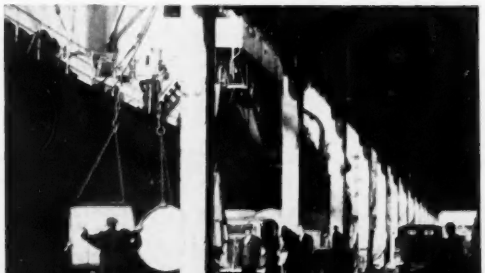


FIGURE 3.—Transhipment of American Ranger Tobacco from ship to road transport at Avonmouth. Tobacco has figured in Bristol's imports since early in the seventeenth century, when the city was Britain's chief port for the American trade. (Courtesy of the Port Authority.)

and waste materials substituted, but in 1937–1938 rather more than 100,000 tons of wood-pulp were imported into Bristol in addition to other types of paper-making material, chiefly from Scandinavia, Canada, the U. S. A. and Africa.

The industry now has a great many ramifications and widely varied branches but in general it can be subdivided into two main categories. The actual manufacture of paper and cardboard and their use in the production of paper bags, card boxes and cartons, stationary and envelopes and its associated ruling and printing forms one branch, whilst the high quality printing and colour-printing trades using art paper and card for the production of catalogues, calendars, birthday and Christmas cards and book-plates forms the second branch, which is really a Fine Arts publishing industry. The first branch of the industry is now dominated by a comparatively small number of very large firms including Messrs. E. S. & A. Robinson, the St. Annes Board Mills Co., and Messrs. Mardon Son & Hall, a firm associated with the Imperial Tobacco Company and concerned largely with the production of containers, paper and advertising for the tobacco industry, which between them employ well over 8,000 people.

FIGURE 4.—Dockside storage of American Tobaccos at Avonmouth. Processing of tobacco, like manufacture of cocoa and chocolate, constitutes one of Bristol's oldest and most famous industries. (Courtesy of the Port Authority.)

The large concerns do of course include in their output large quantities of high grade paper and coated board of the "Bristol Board" type, and have a considerable trade in colour printing; and in the case of Messrs. Robinsons manufacture fine art products and stationery. On the other hand there are a number of much smaller firms in the city engaged in manufacture of paper and paper board, boxes, corrugated paper, paper bags and similar products but in the main it is true to say that the large number of small firms in the industry in Bristol have concentrated on the Fine Arts publishing and specialised printing branches of the trade. Apart from the Fine Arts publishing trade proper, in the production of calendars, cards, book-plates, showcards and pictures, many smaller firms tend to concentrate on specialised printing and publishing for the legal and medical professions and in manufacture of account books, counterfoil books, maps and illustrated guide books. In Bristol itself there are about 50 such firms, 20 of them having less than 50 em-

FIGURE 5.—A famous tobacco mill at Avonmouth showing pneumatic gear at the right of the main building, and a truckload of tobacco in transit by highway to the city. The tobacco industry still remains in the center of the city, and in Bedminster, where one factory employs more than 6,500 workers. (Courtesy of the Port Authority.)

ployees, so that the industry as a whole is a mixture of traditional small and often highly specialised firms housed in chapels or small factories in the heart of the city, on the one hand, and large firms on the other hand, embracing many if not all branches of the trade and using large modern factories, some of them in the outskirts of the city.

In the main, the paper and printing trades in Bristol have tended to specialise therefore in the higher quality types of material; and in order to maintain the very high standards demanded in the printing branch of the industry the Merchant Venturers Technical College provided a separate establishment for the training of recruits to the trade where the pride of craftmanship on which the city's pre-eminence is based, could be inculcated.

Although there is small export trade in paper containers and certain colour-printed articles, by far the greater part of the output of these industries is, like that of the tobacco and chocolate industries, destined for the home market. Here too the products are essentially consumer goods, demands have been rising and there seems every reason to suppose that they will continue to do so. Before wartime scarcity of raw materials made it impossible, public opinion demanded that almost all commodities, particularly foodstuffs, should be sold wrapped or packed, and use of paper and card or waxed containers for this purpose will almost certainly continue to increase. Similarly tremendous increase in publicity schemes and advertising is making increasingly heavy demands on a branch of the paper and printing trades in which Bristol has always specialised and there is comparable increase in demand for all types of books, whilst it is to be expected that the home market for stationary, envelopes, account books and similar articles will at least remain at its present level.

Tanning and making up of leather goods is a fourth old-established industry in Bristol, and like the paper industry, it originally used local materials; but in recent times it has had to augment its supply of skins derived from surrounding counties with those imported through the Port of Bristol. The industry actually extends beyond the administrative boundary of the city into the urban

FIGURE 6.—View down the Avon from the entrance to the City Docks, with a graceful suspension bridge in the background, and one of the tobacco warehouses of the Port Authority in the right foreground. (Courtesy of the Port Authority.)

district of Kingswood in Gloucestershire but as this district is an integral part of the conurbation of Bristol and contiguous with the district of Hanham in which many of the Bristol leather working factories are situated, the two may be considered together. There is, however, marked distinction between the city and Bedminster area on the one hand, which includes tanneries and firms manufacturing general leather goods such as cases, trunks, harness and fancy goods, and the district of Hanham and Kingswood on the other hand with its manufactures of boots and shoes, which might almost be regarded as a separate industry. Indeed the boot and shoe industry of Kingswood has had a completely separate history from the general leather trade of Bristol, since whereas the industry as a whole has grown steadily and remained reasonably prosperous, the boot industry of Kingswood was one of the few industries of any importance locally which has suffered a severe depression in recent times. The depression arose from the fact that the Kingswood firms had always specialised in the heavy types of boots for industrial and agricultural workers and unlike most Bristol industries it was therefore closely linked with the industrial and agricultural fortunes of the country as a whole. With the industrial depression before the war, particularly in the coal industry, and the mechanisation of agricultural methods, demand for this type of heavy boot collapsed and quite serious unemployment resulted. During the past fifteen years, however, the Kingswood industry has been largely converted to the manufacture of light shoes, including ladies and children's shoes so that it can rely on the relatively steady demands of the normal home market and in this respect it now conforms more nearly to what is generally true of most Bristol industries, whilst the prosperity of even the heavy boot branch of the industry has been assured during

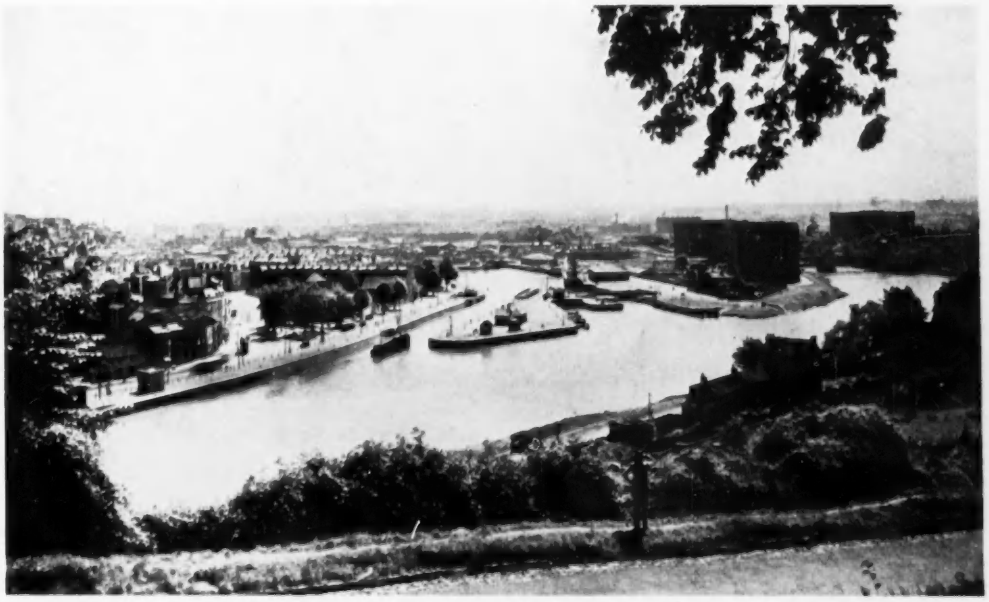


FIGURE 7.—Vista of Bristol and its environs with entrance to the City Docks in the foreground. The large buildings in the right middle distance are tobacco warehouses of the Port Authority and beyond them a tobacco factory of the largest firm in the industry. (Courtesy of the Port Authority.)

the last six years by the very heavy demands for the forces.

Manufacture of non-ferrous metals forms a group of industries that has grown rapidly in recent years, but it too is one of the occupations of great antiquity in Bristol; and here once again we have a case of a long established and continuously practised industry which has now taken on a new impetus and continues to prosper. The local limestones of the Mendips and the downs round the city, contain ores of lead and zinc and it is certain that lead at any rate, has been worked since the beginning of recorded history and by the beginning of the 17th century its manufacture and associated extraction of silver had reached considerable proportions. Local zinc first became important during the 17th century when it was used in manufacture of brass along with Cornish copper which could be bought very cheaply at the period as a bye-product of the gold, silver and tin mining and which was easily shipped to It was during the 18th century however that manufacture of lead, brass and zinc developed most rapidly in Bristol. By the middle of the century there was a large lead-producing plant near Hotwells and in 1752 the making of lead shot was commenced in Bristol and still remains as a specialised local industry. The large scale production of zinc commenced in 1743 at Warmley, whilst Cornish copper was smelted in Bristol to supply the local brass industry which in the later half of the century expanded to such an extent that it was producing half the total British output of brass wire. In the 20th century production and use of brass and copper has declined though there are still a number of firms in Bristol engaged in the trade. Expansion of the non-ferrous metal industry has therefore been largely due to increased production of other metals and metal salts including aluminum sulphate, lead, antimonial lead, tin, zinc, solder alloys, antimony, cadmium, cadmium-nickel and other anti-friction bearing metals, calcium-aluminum and copper sulphate and derivatives. The expansion has been due in part to changes of metallurgical technique in recent times with its increased use of new metals and of light metal alloys and the great development of the use of non-ferrous metals in alloy steels. In war-time the expansion has been even more marked and employment in the industry has increased from approximately 2,000 to almost 3,000, though it may be a temporary phenomenon. However it will be seen later that in the 19th and 20th centuries there has been a great growth of engineering and metal working industries in the Bristol region which has contributed, perhaps more permanently, to the prosperity of the local non-ferrous metal trade, which in turn supplies bearing metals, solders and small castings to the engineering industry, zinc for the very extensive Bristol trade of galvanising and tin for the tinplate industry, whilst one branch of the non-ferrous industry has specialised in the production of type-metal for the printing trades. The industry was formerly centred in the city itself and in the

FIGURE 8.—Waxed paper factory at Fishponds, one of the specialised phases of the paper industry in and about Bristol. More than 11,000 workers in the paper trades are employed within the city itself, besides considerable numbers in adjoining areas of Somerset and Gloucestershire. (Courtesy of Messrs. E. S. and A. Robinson, Ltd.)

Warmley district of Gloucestershire which adjoins the city on the east; in recent times the establishment of the very large plant of the Imperial Smelting Corporation and its subsidiaries at Avonmouth has altered distribution completely and of the 2,000 employees in the industry before the war more than half were employed by this group of companies. The site of the works immediately north of the main dock at Avonmouth was a natural choice since they depend largely on imported zinc concentrates and other ores which can be transferred by overhead ropeway from the dock-side to the factory, whilst at the same time extensive areas of suitable land for large scale industrial development were, and still are, available in this coastal tract north of the Avon.

The activities of the subsidiaries of the Imperial Smelting Corporation form a link with the next of the Bristol industries, since these concerns, in addition to their metallurgical products, specialise in the manufacture of several categories of heavy chemicals, including large quantities of sulphuric and hydrochloric acid, fertilizers, wood and fabric preservatives, aluminum sulphate and other chemicals associated with the corporation's metal production. The only other large scale producer of heavy chemicals in Bristol is also a branch of a large corporation, the I.C.I., whose works at Netham, on the east side of Bristol, produce, in addition to acids and soda, ammonium chloride which is used in the galvanising industry, salammoniac and other general chemicals.

FIGURE 9.—Avonmouth works of the Imperial Smelting Corporation and subsidiaries, specialising chiefly in non-ferrous metals and chemicals. Manufacture of non-ferrous metals is one of the occupations of great antiquity in Bristol. By the beginning of the 17th century lead had been won and wrought in the city from deposits in the neighboring Mendips limestones. (Courtesy of Imperial Smelting Corporation.)

The two large scale representatives of the heavy chemical industry in the Bristol region are, however, recent developments and the older chemical industries of the city area of Bristol are mainly in the hands of much smaller concerns who specialise in the light side of the industry. Of such trades, which can be classified under the general heading of chemical and allied trades, the oldest is that of soap manufacture. Mentioned as early as the 12th century, soap boiling was an old and firmly established industry in Bristol by the first half of the 17th century when it was strong enough to resist the monopolists and royal restrictions of the Stuart period, and it has survived to the present time in spite of the recent tendency towards the centralisation in the British soap industry. The firms engaged in soap manufacture are in all cases producers of candles, oils, greases and waxes and similar goods. Other firms specialise in the making of polishes and in the production of glue, gelatine and bone manure, using as their raw material the bones and skins destined for use in the local leather industry. The pharmaceutical and toilet side of the chemical industry is also represented in Bristol, there being one large firm of general manufacturing chemists and five concerns producing patent medicines and toilet goods which are sent to all parts of the British Isles. The manufacture of chemicals and inks for the paper and printing industry is a specialised local trade. Altogether the varied chemical industries employ just over 1,000 people and their steady and continued prosperity arises chiefly from the fact that their products meet the demands of a market which is domestic rather than industrial and for home consumption rather than for export, and they have therefore been little affected by industrial or trade depressions.

Closely allied to the chemical and non-ferrous metal industries is the considerable production of paints, varnishes, enamels and pigments in Bristol. The local non-ferrous metal industry supplies white and red lead used in manufacture of paint and zinc oxide used as a base for enamels. Linseed oil is crushed in Bristol from imported seed and turpentine is also imported. One other local resource of importance

FIGURE 10.—Extensive works of the Imperial Smelting Corporation and subsidiaries, at Avonmouth. Local ores of lead, zinc and silver, and Cornish tin, gold and copper, formed the initial raw materials for the industry, which now derives its ores from a multitude of sources, and wins and works a multiplicity of metals. (Courtesy of Imperial Smelting Corporation.)

in production of pigments is the availability within a few miles of Bristol of ochres and oxide earths which are manufactured into a complete colour range of natural pigments by three firms at Wick, Bitton and Winford. There are now twenty firms engaged in the industry in Bristol and the importance of their output is out of all proportion to the comparatively small labour force of under 1,000 since the industry is one that lends itself readily to mechanisation and several of the firms are among the most famous in the country. The paint industry is one which has had to reduce production heavily in war-time owing to the shortage of imported materials, but the demands of the home market will inevitably be heavy indeed when the control of expenditure on property repairs is withdrawn, and the industry like most of Bristol's trades depends almost entirely on the home market and will consequently enjoy assured prosperity for some considerable period.

The last of what may be regarded as the older industries of Bristol is the group of clothing industries which still remain in the city. They are specially interesting in that they are really remnants of the West Country woolen industry, the nearest approach to staple industry that Bristol or the West of England has ever known. With collapse of the former extensive and important wool manufacturing industry there remained only isolated wool producing areas such as Stroud and similarly isolated clothing industries in such towns as Taunton and Yeovil and in Bristol where the former woolen materials had been made up. The present industries employ some 3,000 people, with a large proportion of women, and whereas there are four firms engaged in the wholesale ready-made tailoring trade who employ over 100 persons each, one of them normally employing 900, and two large firms of corset makers, yet in the main it is an industry of small firms, many of them with less than 50 employees.

The large and rapidly growing volume of consumer goods imported through Bristol during the present century has given rise to new industries in the city of Bristol and its outport at Avonmouth which are based on the processing and manufacture of these goods. Immediately before the war the total imports were 2,976,733 tons composed as follows:

Foodstuffs (human and animal)	1,389,117 tons
Petroleum products	905,675 tons
Wood and wood pulp	266,205 tons
Other imports	406,776 tons
	2,976,773 tons

Large numbers are not employed in the handling and refining of the oil cargoes and it is therefore the foodstuffs and wood that form the basis of the large local industries, though the category "other imports" include the raw materials for some of the industries already mentioned and other smaller ones.

There are approximately 5,000 people employed in Bristol in the food industries, though it is difficult to arrive at the precise number owing to the fact that there are a large number of small firms who combine food processing with other activities. Bristol's imports of foodstuffs under normal conditions are made up as follows:

Grains and oilseeds	998,794 tons
Animal feeding stuff	162,566 tons
Fruit	108,708 tons
Other foodstuffs	119,049 tons
	1,389,117 tons

So it is clear that the milling and processing of grain and the preparation of animal fodder form a large part of this industry. During the war this position has been completely altered by war-time agricultural policy and by the enforced restriction of imports. This is of course aggravated at the present time by the complications of the world grain position

but the eventual restoration of former conditions is to be expected. The figures for 1944 and 1945 are as follows:

	1944	*1945*
Petroleum products	3,616,916	4,440,158
Wood and wood pulp (approx.)	120,000	110,000
Foodstuffs (human and animal)	1,107,334	847,361
Grain and oilseeds	526,495	402,785
Animal fodder	1,030	24,577

The very high figures for petroleum imports are due to the heavy demands for the services and the fact that Avonmouth replaced more vulnerable localities as an oil handling port during the war. (See "The Port of Bristol," ECONOMIC GEOGRAPHY, Vol. XV, No. 2.)

Until the end of the last century most of the grain was landed in the city docks and seven of the thirteen firms of flour and provender millers have their works in the city itself, though they are the older and rather smaller firms. They are, moreover, with one exception, the firms which specialise

FIGURE 11.—Part of a new and modern mill recently completed at Avonmouth, of large capacity and up-to-date equipment. (Courtesy of Port Authority.)

in milling wheat flour for human consumption and preparation of patent self-raising flours rather than milling of animal provender. Some of their supplies still arrive at the city docks in vessels suitable for the navigation of the Avon and at the same time capable of making the Atlantic crossing, but most of it is transhipped at Avonmouth and brought to the city by barge or land transport. The vast majority of grain vessels now land their cargoes at Avonmouth, partly because of the special grain handling equipment installed there (see "The Port of Bristol," ECONOMIC GEOGRAPHY, 1939, Vol. XV, No. 2) and in the case of the large milling plants of the Cooperative Wholesale Society, Messrs. Spillers and Messrs. Hosegoods the layout is arranged so that the grain can be transferred by pneumatic and conveyor apparatus direct to the mills. Each concern deals with human and animal foodstuffs, whilst Messrs. J. Robinson's mill nearby handles oilseeds and produces oilcake for fodder, and each employs approximately 400 people. With one exception the other firms in this branch of the food industries usually employ not more than about 50 or 60 persons. The fact that Bristol's imports of grain were doubled in the first 40 years of the present century is sufficient indication of the prosperity and growth of both the trade and its associated industry in recent times; all the large mills and granaries at Avonmouth have been built during this period. The importance of grain products in the trade and industry of Bristol is of course a natural and reasonable phenomenon when it is remembered that Bristol acts as distributing centre as well as port for the Southwestern counties of Gloucestershire, Wiltshire, Somerset, Devon and Cornwall where in the more normal agricultural conditions of peace, permanent grass and animal husbandry are the normal order and there is great deficiency of grains and heavy demand for animal fodder, especially as three of the counties named specialise in the dairy side of stock farming.

Fruit and sugar imports of Bristol provide at any rate part of the materials used by four firms manufacturing jams, three firms manufacturing jellies,

and three makers of fruit syrups and squashes. Apart from such trades, however, remaining foods manufactured in Bristol are extremely varied and of general character including production of biscuits, sauces and pickles, bacon, cooked and processed meat and sausages, confectionery and maize meals and starches. Most of the firms concerned are small; of the 60 firms engaged in such general foodstuff trades only 10 normally have more than 100 employees.

Allied to the food industry is the brewing trade which is of considerable importance in Bristol; there are four quite large breweries which together employ about 700 people in normal times. The Distillers Company have also a large plant in Bristol for manufacture of yeast used in the brewing industry and the local bakery trade. Though not strictly speaking an industry, import and bottling of wine is a local occupation which dates back to mediaeval times and there are still eight firms engaged in the trade, ensuring that at any rate one of Bristol's very varied occupations enjoys a world-wide reputation.

Though woodworking industries on a limited scale have existed in Bristol for centuries, their modern counterparts share with foodstuffs industries a great revival and expansion in recent times arising from the considerable timber imports which have come into Bristol during the last 60 years. During this period volume of wood imports has remained fairly steady, however, and there has not been quite such phenomenal growth during the present century as that of the grain trade. A large proportion of timber imports consists of soft-wood and building timber and the firms of saw-millers and timber stockholders in Bristol naturally supply the needs of the building trade and of agriculture throughout Southwest England. Of the 45 firms engaged in woodworking occupations in Bristol two-thirds are therefore engaged in the initial sawing and distribution of timber from the port, who employ very small staffs and supply the needs of Bristol itself and the surrounding counties, whilst a further part of the timber imports is handled by building contractors and a host of small firms who combine joinery with other building occupations. In addition to these occupations, which are

FIGURE 12.—Unloading grain at one of the largest and most modern mills in Bristol. The vast majority of grain vessels now land their cargoes at Avonmouth, partly because of the special grain-handling equipment installed there. (Courtesy of Port Authority.)

FIGURE 13.—Cooperative Society's mill at Avonmouth, with its overhead conveyor apparatus for transferring grain direct to the mill. Bristol's imports of grain doubled in the first forty years of the present century, indicating how rapid has been the growth of the grain and milling trade, as well as its prosperity. (Courtesy of Bristol Port Authority.)

normal to almost every port, Bristol has however a group of sizable industries which are of a more specialised nature but which depend on the supplies of timber and the developing trade in hardwoods at Avonmouth for their raw materials. There are three large firms manufacturing furniture, including one specialising in school and hospital furniture, one firm making picture frames, another specialising in production of doors and sectional and transportable buildings and a sixth, one of the largest of its kind in the country, which concentrates on shop design and shop-fitting, a trade which formerly used wood almost exclusively, though nowadays other media are becoming more common. Before the war approximately 2,000 people found employment in the woodworking industries, if we exclude the smaller users of timber, but during the war the figure rose to well over 4,000, largely because use of wood in manufacture of munitions cases and packing cases for war-time stores, some of which was carried out by the expansion of existing joinery firms, making of wooden packing cases being already a considerable local industry, and the rest was produced in new factories taken over by the firms or by war-time organisations.

Apart from the old-established and traditional industries of Bristol and industries based on principal imports, there are a great many other varied trades on a smaller scale, some of them based, it is true, on very old crafts in the city, but some completely new. The small scale manufacture of pottery and glass, for example, has very ancient origins, the construction of small ships is as old as the port, and brick-making is another very important and expanding industry which has a long history in the area. On the other hand, weaving and processing of asbestos for industrial friction gear and brake-linings is now an important local industry in the Brislington area though it was introduced into the city less than 30 years ago. Rubber manufactures are another relatively recent introduction to the industrial economy of the city, whilst brush-making, though an old craft in the city itself, has greatly expanded within the last 30 years as result of achievements of one firm in Kingswood which has

FIGURE 14.—Flour and provender mills in the City Docks area. Milling of grain products for the animal husbandry districts of the south-western counties of Gloucestershire, Wiltshire, Somerset, Devon, and Cornwall, where, under normal conditions, grazing is the dominant agricultural use of the land. (Courtesy of Bristol Port Authority.)

evolved a new technique in brush-making bearing little relation to old methods and which has gained international reputation for their goods.

Of all recent changes in the industrial pattern in Bristol, however, by far the most important is growth of the engineering trades. Immediately before the war the total number of employees in general engineering occupations in Bristol was approximately 7,000, excluding the aircraft engineering industry which must be treated separately, so that the occupations may be regarded as the fourth of Bristol's major industries along with foodstuffs, tobacco and printing and paper trades. Development of engineering to become an industry of such magnitude, though it has been called a recent phenomenon, is not sudden; it is the outcome of steady progress throughout the last century and in the case of certain particular branches of engineering has roots which are very much older. Perhaps the reason why so little is known outside Bristol of this side of its industrial life lies in the great variety of products of the industries, which means that no single commodity is sent to other parts of Britain or into the export market in large quantities.

The origin of a great many engineering products in Bristol lies in production of machinery and equipment used by other industries in Bristol itself and it is not surprising that machinery for the tobacco and chocolate-making industries has been constructed here since the middle of the 18th century. Machinery for paper making and printing trades has naturally been manufactured in Bristol and there has also been very specialised development of construction of machines for paper bag and box making and printing. This branch of the engineering industry also supplies the printing trade in other parts of the British Isles and there has been comparable expansion beyond needs of local industries in manufacture of machinery for boot and shoe trades, brewing and bottling industry, paint, colour, ink and allied trades, woodworking industry, wire-brush making and bakery trade. All the engineering activities share with the industries for which they cater, a preoccupation with the home market and the supply of consumer goods, and the same is true of the manufacture of equipment for the dairying occupations of the surrounding counties. All have shared in the relative immunity of the occupations from affects of general trade and industrial depressions.

Apart from manufacture of industrial plants the only other generalisation which can be made about the bewildering variety of engineering occupations in Bristol is that they tend to concentrate on production of lighter and smaller types of metal articles, and include a considerable production of sheet metal, metal containers and hollow-ware, much of which is tin-plated or galvanised, using tin or zinc provided by the local non-ferrous metal industry, whilst there are a number of firms engaged in the chromium, nickel, cadmium and silver plating and enamelling of similar articles. Tin-plated or galvanised wire also forms the basis of a fair sized wire weaving industry and manufacture of netting, wire ropes and other wire products. The remaining engineering industries are so varied that it is impossible to divide them into general categories. They include firms using sheet metal for making of ventilating plants, others specialising in the manufacture of lifts and hoists, metal windows, weighing machines, valves of all kinds, metal tubes, machine tools, screws, nuts, bolts, chains, boilers, automatic selling machines, mechanical hammers and a whole host of similar articles.

Indeed apart from the actual smelting of iron and steel from ore, almost every branch of metal working and engineering industry is represented in Bristol. The very extensive engineering industry also includes a group of firms engaged in production of motor vehicles, chiefly small industrial trucks and large passenger vehicles which have been supplied to public transport undertakings all over the British Isles.

During the war, in common with the engineering industry throughout the country, the Bristol engineering trades expanded greatly and employed very nearly double their peace-time numbers, though their production had to be converted to war-time needs and munition manufacture. Most of the additional labour supply came from the other Bristol industries whose peace-time employees were directed into war industry; with the end of hostilities the process is being reversed and the engineering industries are rapidly reverting to more or less their former level.

Of all changes in war-time and in the period of re-armament which preceded it, one of the most remarkable was the development and expansion of the aircraft industry in the West of England. Though much of the development took place in areas of Gloucestershire, Wiltshire and Somerset some distance from Bristol, yet the already large aircraft industry of Bristol itself grew considerably. As far as this industry is concerned Bristol must be taken to include the Rural District of Sodbury in Gloucestershire in which the Bristol Aeroplane Company's works at Filton and the aircraft factory at Yate are situated, since the labour force for the two concerns has been drawn very

FIGURE 15.—Oil installation and tanks with Avonmouth Docks in the middle distance, illustrative of facilities for industrial and commercial activity of Bristol. (Courtesy of the Bristol Port Authority.)

largely from Bristol and the plants have become essentially part of the Bristol industrial complex. The inception of the aircraft industry in the Bristol region dates back to the formation of the Bristol Aeroplane Company in time for their aircraft to play an important part in the 1914–1918 war and the concern had grown so rapidly that by end of the war. Nevertheless even the prewar size of the aircraft industry was most impressive, and with expansion of civil aviation it seems likely that the position at least will be maintained, so that the industry will probably continue to be by far the most important local manufacturing occupation and double the size of any other local industry.

FIGURE 16.—Launching a cargo vessel in one of the old shipbuilding yards of the City Docks. Shipbuilding is an even more ancient industry in Bristol than processing of cocoa and tobacco. (Courtesy of Bristol Port Authority.)

1939 it employed some 18,000 people. Altogether in 1939 the aircraft industry employed about 22,000 people in the Bristol area in its larger sense, as defined above, and during the war the figure rose to 30,000, the increase being largely taken up by workers employed in the industry in the city of Bristol itself. Most of the 7,000 odd workers in the aircraft industry in Bristol during the war have been in the employment of a large number of general engineering firms which have converted their output to parts and components supplied to the Bristol Aeroplane Company and other aircraft companies; the arrangement ceased or will soon cease with

It represents a change of balance in the region's industrial make-up without precedent, since no industry had previously outstripped the rest so completely. At the same time the fact that so large a proportion of the Bristol aircraft industry is under control of one firm represents another rather important development because, though it follows the tradition of the large firms in the tobacco and chocolate industries, it is on so large a scale that it is scarcely comparable. The fact that the Bristol Aeroplane Company has been most enlightened, and has a good record of continued prosperity and development has meant that the changes have merely

been circumstances associated with the generally growing industrial prosperity of the Bristol region. But the products of the aircraft industry do not conform in any way to the general nature of Bristol's industrial output, since they cannot by any stretch of the imagination be said to cater for a steady home market in consumer goods. The past 30 years have been exceptional in that they have seen the initial rapid growth of the new industry and have included peak periods of aircraft production of two major wars. Though increased use of air-transport will almost certainly ensure that in the immediate future the industry will continue to prosper, the long-term outlook is less certain. When the heavy demands for aircraft during the period of evolution of air transport have been met, there seems no reason to suppose that the industry will be any more immune from wide variations of demand than industries producing the means of land and sea transport. If Bristol should come to depend too greatly on the fortunes of one firm in the industry it might also in the future suffer comparatively serious fluctuations of fortune. However the possible source of danger is still quite remote and may never arise if the Bristol Aeroplane Company continues to maintain its position in the industry as skilfully as it has done in the past. In any case effects of moderate variations of prosperity in any one industry, even as large as the aircraft industry in Bristol, would not be really serious, provided the great range of other industries in the city were maintained at their present level. There seems no indication at present that the aircraft industry is developing at expense of older occupations of the area.

One quite serious consequence of the

FIGURE 17.—Banana-handling plant, and rail connections at Avonmouth. Tanks at the right are for storage of molasses. (Courtesy of Bristol Port Authority.)

great expansion of the aircraft industry in Bristol has risen already, however, as a result of the shifting of the place of employment of some 20,000 workers to the outskirts of Bristol on the Gloucestershire side at Filton and even farther afield at Yate. Prior to the development the industrial life of Bristol had been concentrated in the city itself and continuous urban area of Kingswood and the compact distribution of housing with comparatively little ribbon development had served quite well. The needs of Filton itself had been partly met before the war by development of large building estates in Filton, Patchway and Horfield, but the war-time suspension of house-building has meant that this method of solving the problem has fallen into arrears. A large part of the labour supply for Filton has therefore to travel from Bristol, sometimes a distance of several miles from the Somerset side of the city, a state of affairs which is quite new in the Bristol area, and one which has necessitated a considerable revision of the city's transport system and provision of special 'bus routes and services to meet the peculiar needs of the case. The problem is even more serious in the case of the aircraft works at Yate, especially as labour needs of the Yate-Chipping-Sodbury area have been augmented by development of an electrical equipment works and establishment of a new paper and board works at Chipping-Sodbury. Here the distances involved are greater and so far no large scale house-building programme has been possible in the district, so that once again special road transport services have had to be provided, though considerable numbers of workers travel by rail from Bristol to Yate. It is not yet clear what the best solution to the problem would be, but it seems possible that development of something in the nature of a small satellite town in the area might meet the case.

Apart from such redistributions arising from the aircraft industry there has been comparatively little change in location of industry, the only important exceptions being the move of Messrs. Fry's works to Keynsham and the industrial development of the outport of Avonmouth. The latter has been a rather specialised and very necessary change, since the three major industrial occupations developed in this district are grain milling and processing, non-ferrous metal and chemical manufactures and oil refining, all of which depend on handling bulk cargoes which arrive at Avonmouth and for which that port is specially equipped. Moreover labour needs of the particular industries are comparatively small when related to the volume and value of the goods produced and can be provided by the housing development at Avonmouth itself and the Shirehampton-Sea Mills area and by the excellent existing road and rail transport system between Bristol and Avonmouth.

In summing up the general industrial character of the Bristol region, if one omits the rather special case of the aircraft industry, perhaps the most significant fact to emphasise is the tremendous range and variety of Bristol industries and the absence of any one occupation which might be regarded as dominating the economy of the city. The Bristol Development Board calculate that there are some 300 different industries in the city if the multitude of different engineering occupations are treated separately. In view of the great diversity of occupations it is all the more remarkable that almost without exception they share the two features which have always tended to characterise Bristol's trade and industry. In the first place they almost all cater primarily

for the home market and are in no way dependent on overseas trade, though of course individual firms do export appreciable quantities of particular goods. And in the second place almost all Bristol industries manufacture articles which are consumed regularly and for which there is steady and constantly recurring demand, or alternatively they are engaged in manufacture and maintenance of machinery and equipment for such industries.

From the point of view of economic organisation Bristol is essentially a city of exceptional contrasts. It is the home of industries like the tobacco, chocolate and aircraft manufactures which in Bristol are dominated by single undertakings, but in all the other industries, even including the paper and printing trade, though there are large firms, it is the home of large numbers of extremely small firms, most of them highly specialised and many of them very long-established.

Bristol, therefore, in its industries as well as in its commerce and trade contrasts sharply with the other ports of the West Coast of Britain and the industrial areas of Northern England with their dependence on single staple industries and on the export trade and their unfortunate experiences in times of industrial and trade depression. It may be compared, rather, with the industrial and commercial region of Greater London and in fact, since mediaeval times, the two cities have been rivals in almost every field of commercial and industrial activity, and at times, particularly in the 17th century the rivalry produced bitter feeling between them. Now however the two regions share more amicably the rising industrial prosperity of Southern England; both have an enormous range of industries, supplying mainly the home market, both concentrate on the lighter and newer industries, and even in outward appearance one is reminded of the rising industrial belt of Western London in Brislington and other suburbs of Bristol.

EL SALVADOR

Minnie E. Lemaire

EL SALVADOR, the smallest of the Central American countries (slightly larger than Vermont), yet the most densely populated, reveals itself as a most interesting, beautiful and fascinating land. The present reaches back historically and reflects characteristics of pre-Columbian times. Archeologists aver that even in the past, as in the present, the region contained a relatively dense population. Early inhabited by the Pipiles, offspring of the mighty Aztecs, the region west from the Rio Lempa bore the name Cuscatlán. The river, particularly, determined the migration of peoples in the vicinity and along with other river valleys became a center of settlers and so began the present pattern of the state. El Salvador lent itself as a node of trade routes which reached well to the north in Mexico and south to Colombia and beyond. Don Pedro de Alvarado, one of Cortes' group, with his army started the conquest of Cuscatlán in 1522 and by 1525 the city of San Salvador began to emerge as a definite entity.

Because of its peripheral location, El Salvador was little subjected to the evils of Spanish rule, and once voted for annexation to the United States rather than to Mexico. Nevertheless it supported the movement for independence and declared its own as of September 15, 1821. El Salvador has advocated and favored a Central American grouping. For two decades, 1821–1841, along with Guatemala, Honduras, Nicaragua and Costa Rica, it supported the Federation of Central America and even today headquarters for such a federation are located in El Salvador. Friendly relations exist among the Central American countries and problems are settled peacefully as indicated by the Guatemalan-Salvadorean boundary treaty signed April 9, 1938 after recommendations made by a committee composed of a delegate from each country and a neutral chosen by the Pan American Union. Although minor boundary changes have been made, present boundaries remain very nearly as in the past.

Virtually sitting atop a boiling caldron, El Salvador is more volcanically active than any of the other Central American Republics. Eleven major volcanoes, mostly inactive, stand astride the country. Three volcanoes, San Salvador, San Miguel and Mount Izalco have erupted during the last century and the last stirs quite constantly, so much so that the mariners call it "Faro del Pacifico" (Lighthouse of the Pacific). Much of the region has been covered by lava; many volcanic lakes dot the landscape and ash deposits extend often to considerable depth. Several of the lakes which occupy old craters are Güija, Coatepeque and Ilopango (Figure 1).

San Salvador has been destroyed by earthquake shocks and tremors seven times since its foundation, and the Indians, well aware of these earth movements, claimed that they were caused by the swinging of their hammocks, and so named the major valley "el valle de las hamacas." Due to the tremendous loss occasioned by the earthquakes more aseismic construction of reinforced concrete like that in the National Palace,

which withstood the shocks of 1917 and 1919 with little damage, becomes a necessity. For the adobes construction known as bakareque might well be studied and used. It involves a frame of wooden poles with woven branches, plastered, both inside and out, well tied together and firmly fixed in the ground.

In spite of its many volcanoes El Salvador has a landscape more nearly that in the north which extends west to east and constitutes the foothills of the mountain masses of southern Honduras.

El Salvador illustrates well, climatically, characteristics of a hilly to mountainous country located in the wet and dry low latitude regime. Variations result from differences in altitude, exposure of slopes and proximity to the coast. San Salvador records relatively small average

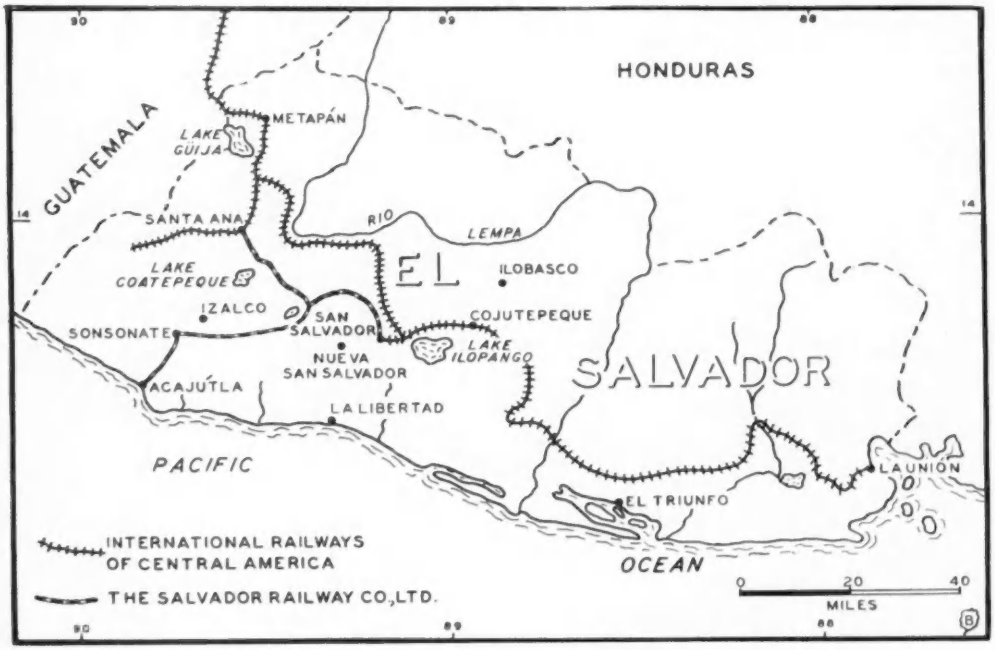


FIGURE 1.—Volcanic lakes, major cities and railroad lines of El Salvador, expressions of the country's characteristics and activities.

of highland topography than that of mountain range. Four rather distinct physiographic regions may be defined. On the south a narrow plain not much more than fifteen miles wide at its greatest width extends along the coast. Inland the Pacific Mountains or Coastal Range containing some semiactive and dormant volcanoes rise up to 8000 feet elevation. The more or less intermontane plateau embodies within it two important river valleys, those of the Lempa and the San Miguel. The plateau blends into a mountainous area

temperature ranges from month to month although within a year such as 1935, the maximum might be 37.6° C. and the minimum 11.5° C. (Figure 2). The rainy season falls within the months May to October with small amounts recorded in the other months. Heavy convectional rains account for the summer precipitation. Occasionally a very heavy rain forms a deluge as on June 6–7, 1934 when damage of $1,000,000 struck the railways, roads, and forts and, in addition, caused great loss of life and crops. Destructive hurricanes

are rare in the region. The southern coastal belt receives approximately 60″–70″ of precipitation, a central belt which includes the higher peaks, about 80″–90″, and a northern belt 70″–80″. The northwestern sector of El Salvador generally receives the least amount of rainfall, averaging less than 60″.

When in El Salvador the visitor can easily sense the industriousness, the progressiveness and intelligence of the populace. Because of the very denseness of settlement no time can be lost or wasted and hard work is the order of the day. The estimated population as of the last day of 1942 was 1,862,980 on 13,176 square miles which gives an average density of population per square mile of 141.39. In its political divisions El Salvador has 14 departamentos and 259 municipios. The three most popu-

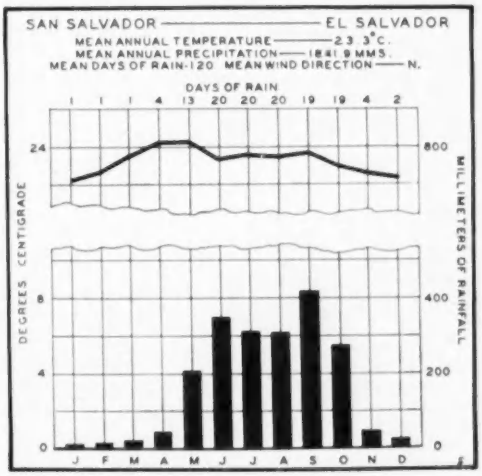


FIGURE 2.—Climatic chart of San Salvador, El Salvador. Precipitation and temperature regions are distinctively characteristic.

lated departamentos are San Salvador, Santa Ana and San Miguel (Figure 3) whereas the three largest urban centers are San Salvador (105,193), Santa Ana (46,343) and Nueva San Salvador formerly known as Santa Tecla (23,755) which really constitutes a part of the metropolitan district of the capital.

The ethnic composition of the state is based on an advanced mestizo of Indo-Hispanic stock accounting for about 80 per cent of the peoples. The 10 per cent of full-blooded Indians have embraced the speech and customs of the Spanish to the point where their own dialect is almost obsolete. Just about balancing the pure Indian group is the small agglomeration of more or less white aristocracy descended from the Spanish Conquistadores. A smattering of nationals from Honduras, Guatemala, Nicaragua, Mexico, Spain, etc. account for the .6 of 1 per cent of foreigners listed in the population of 1942 as compared to the 99.4 per cent Salvadoreña.

Most people live in the healthful uplands, having located in the central and west portions. The birth rate for 1942 reflects well the rural-urban nature of the country with 37.7 per cent urban and 62.3 per cent rural. With some large estates goes a large number of small landowners. The government wishes to increase this last group and as an example purchased Zapotitan, an hacienda about 13 miles northwest of Nueva San Salvador along the Pan-American Highway, and repartitioned it among small landholders who had been carefully investigated for their ability.

Because of dense population and large percentage of land under cultivation relatively few tracts of dense forest remain. Three of the most common trees are probably the Amate, the Conacaste and the Ceiba. The Amate or wild fig is the national tree and with its wide, umbrella-like top can be seen in practically every village in its center or square. The Conacaste or Guanacaste has rather feathery leaves and pods which the cattle eat when all the available grass has dried up, even though they have little food value. The Ceiba with its buttressed base and flat

top is commonly known as the silk-cotton tree.

One of the most important indigenous native trees is the balsam tree (Myroxylon Pereirae), a leguminous tree which grows mostly at an elevation of approximately 2000 feet in the low mountain districts of the Departments of Sonate and La Libertad. It is commonly known as the "Balsam Coast." Medicinally, balsam is used in compounding ointments and industrially, in making an essential oil often used as a base for perfumes. Plantation forestry is probably out of the question for this tree but as a shade tree for coffee or in reforestation it certainly has definite value.

The mineral zone extends between the cities of Metapán and Santa Rosa. The mining of gold, silver, lead, mercury and other minerals has not been developed to full capacity. Export of the first two minerals ranks second to agricultural products. In 1941 gold to the amount of $1,000,000 was mined.

El Salvador, in spite of its rough to rolling landscape, but aided greatly by its extremely fertile volcanic soils, has placed at least 80 per cent of its area in crop production. The thirst and need for every possible inch of cultivable land even finds people over the brink and into the craters of volcanoes where action is still continuing. Although not entirely self-sufficient in its food demands, the country could more nearly approach this point provided a more adequate and varied diet were introduced and made possible through greater diversification of production.

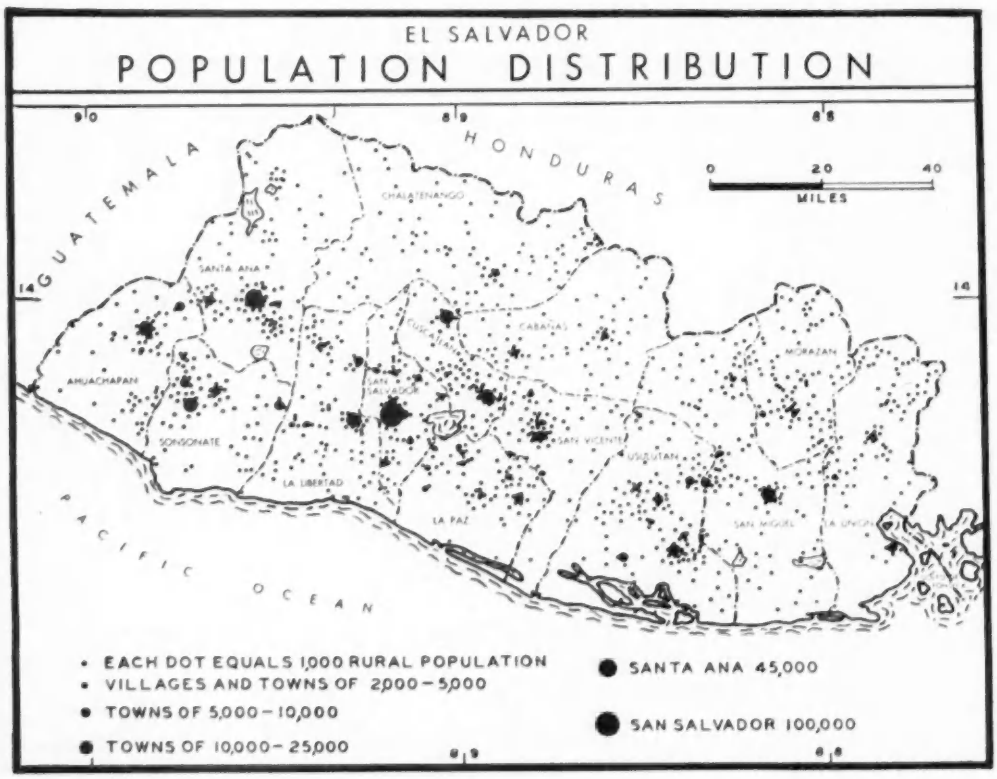


FIGURE 3.—Population distribution of El Salvador. Note concentration of peoples in the central and western sections, where conditions are most favorable for human occupancy and prosperity.

The country, third largest exporter after Brazil and Colombia, has long been considered a one crop region which certainly holds true from a commercial

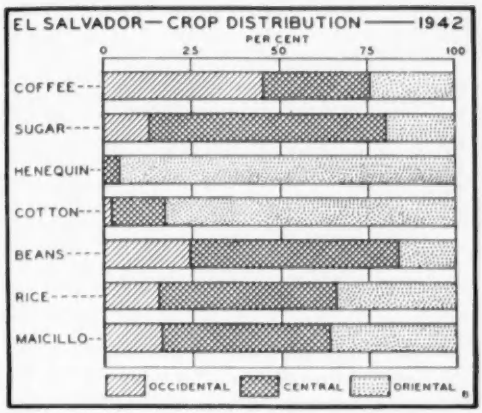


FIGURE 4.—Major crops in El Salvador, according to the west, central and eastern divisions, represent differential adjustments to different kinds of environment.

standpoint. Coffee, accounting for approximately one-third of the total production and more than nine-tenths of the value of exports, holds the center of the stage in interest after having been introduced in 1840 by a Brazilian school teacher. The province of Santa Ana takes first place with one-fourth of the coffee in the nation while La Libertad, Usulután, Ahuachapán and Sonsonate may be credited with the remainder (Figure 4). Pretty much concentrated in the west and central parts, as of 1939, there were 140 million trees growing on 202,000 acres divided among 11,545 coffee fincas and 10,921 proprietors. The acreage might well be increased 50 per cent, for another 100,000 acres could be planted to coffee, but this is, practically, impossible because of other urgent demands on the land. The mild variety (Coffea arabica) grows at an altitude of 1000 feet or more and requires shade. Santa Ana contains modern and efficient beneficios for the preparation of coffee. Two-thirds of the coffee is of the "washed" or mild variety and excellent for blending. During the last decade the coffee industry has had considerable trouble with the result that the government has stepped in to aid as much as possible. In 1938 a subsidy was granted to the Coffee Growers Association (as well as to the stock-raising industry and the National Committee for the Defense of the Sugar Industry). The government after January 1, 1938 waived its claim of 67 per cent on the export tax and the growers paid only the remaining 33 per cent which was allotted to the Mortgage Bank of El Salvador. The Inter-American Coffee convention which met and set quotas for coffee export was ratified by the government on January 2, 1941, the quota for Salvador being 600,000 bags of 132 pounds. Home consumption averages 130,000 bags. Of late, production in alternate years has varied as 1939—40 with a fair crop of 750,000 bags and 1940—41 with a small crop of 667,000 bags a result of insufficient moisture during the wet season, of unseasonable rains and of crop pests, particularly locusts. By August 1, 1942 there was no carry-over as all coffee had been sold. The next crop, however, reached the proportion of 925,000 bags. The Inter-American Coffee Agreement with its provision for a fairly stable market permeated the whole economic structure of the country and kept it well in hand considering the world turmoil and uncertainty.

Prior to the last decade cotton received little attention from growers because foreign cotton was easily imported and because of the damage done by the boll-weevil. With a sharp rise in the import duty imposed in 1936 cotton made great strides with the 1938 crop of 2 million pounds about double that of the preceding crop; 1939 with 2.5 million; and doubled again in 1940 to

5 million pounds. In 1941 a surplus of 3 million pounds was on hand and there was no market in sight. A temporary demand for cotton in Guatemala developed after a warehouse was destroyed by fire and reduced the surplus by nearly half. Cotton plantings increased in 1942, but all growers had to be licensed by the Ministry of Agriculture and had to be members of the Cotton Cooperative of El Salvador which controlled the sale of all the cotton used in spinning and weaving within the country.

The country definitely has an excess of production over consumption in cotton at the present time. Expansion of the cotton textile industry will require much new machinery. Manufacture of new products such as manta, coarse cotton cloth or absorbent cotton, plus expansion of the thread mills and other cotton industries, would take more than present production and relieve a major problem. Loss of import duty to the government could easily be compensated for with the increase in factory organization.

Sugar, the second commercial crop, has shown an increase, although variable. In so far as exports go, Honduras takes the major portion, and the market remains fairly constant because of relatively little competition, although lately Honduras has shown notable increase in its demands. Grown primarily in the central provinces of San Salvador, La Libertad and Sonsonate, sugar occupies the lowland areas. As with coffee, quotas were set for production and export by the Commission for the Protection of the Sugar Industry. The 1941 quota was set at 300,000 quintals as compared to 250,000 quintals in 1940.

Corn with maicillo (according to the Diccionario de la Lengua Española, Real Academia Española, 1925, "(De maiz.) m. Planta de la familia de las gramíneas, muy parecida al mijo, y cuyo fruto, muy nutritivo, constituye a veces el único alimento de algunos pueblos de los aborigenes de la América Central y Meridional"), essential parts of the dietary, occupy a larger cultivated area than any of the commercial crops and along with beans and rice from the Santa Ana and La Libertad districts, make up the main items of food. El Salvador spends quite a sum on imported foods consisting mostly of flour, lard, hams, canned meats, canned fruits and vegetables, sardines, fresh and dried fruit, fresh and dried vegetables, crackers, canned milk, butter and cheese. Much of this could be produced within the country with more emphasis on local production, as practically all of the common vegetables such as cabbage, cauliflower, turnips, Irish potatoes and tomatoes grown in the United States could be cultivated here as well as other vegetables such as the chayote which resembles the cucumber. On the higher mountain slopes temperate fruits such as apples, peaches, cherries and strawberries have been tried with little success except for the strawberry. To balance lack of such temperate fruits, however, are the excellent tropical fruits, mango, banana, plantain, avocadoes, papayas, coconuts, soursops, custard apples, sapotes, sapodillas, oranges, pineapples, pawpaws, mameyes and níspero from the chicle tree.

After wheat production had faded away to practically a negligible amount, local financiers in Nejapa in January 1933 erected a modern flour mill which was operated by a native staff. Although sufficient wheat is not yet grown, the crop has risen greatly from its lowest ebb.

Sisal fiber (known in Salvador as henequin) has been raised for the past ten years or so in sufficient quantity for domestic use in textiles, bags for coffee and sugar, etc. Centered in San Miguel

and Morazán, acreage could well be doubled or tripled, particularly if made attractive by increase in prices. Other crops which would greatly aid in the diversification program of the government are roselle fiber, cacao, rubber, tobacco, millet and derris for rotenone, an insecticide especially desired in the United States. Improvement in the stock of the ever present chickens and pigs would aid the people greatly.

Cattle, some 700,000, graze in the central and eastern provinces on the low, comparatively wide stretches of plain and furnish both meat and milk (Figure 5). The consumption of milk in all forms averages low with ¼ bottle per day per capita. The government has imported many pedigreed animals in an effort to improve the domestic stock. Previous to November 5, 1943, cattle were exported to Guatemala but that market has been lost with the termination of the free trade treaty between the two countries.

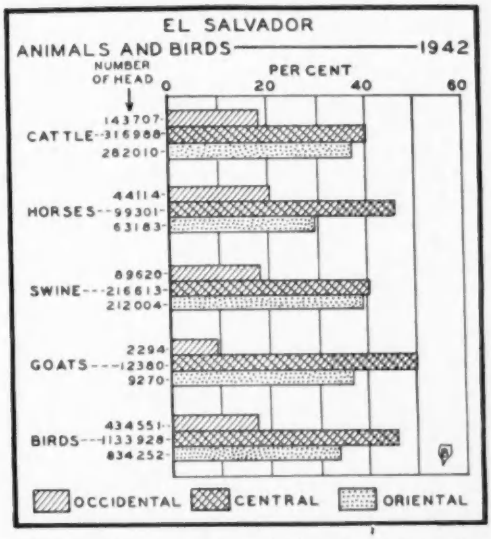


FIGURE 5.—Animals and birds in El Salvador as distributed in west, central and eastern districts. Animal products and industry are dominantly developed in the Central region.

Over 80 per cent of the commercial enterprises in El Salvador are lodged in the hands of native interests. One phase of this interest is manufacturing which depends principally on the products of the land such as coffee beneficios, sugar refining and alcohol manufacture, cotton spinning, the making of clothes, hats, shoes for local consumption, flour milling and fabrication of tortoise shell into combs, trays and brooches. Other industrial products consist of fiber bags for coffee and sugar, leather goods, soap and candles, beer, pottery, matches, cigarettes, iron tools and implements, and vegetable oil. As in other regions many cities specialize in and are known for certain goods: for example Izalco (Sonsonate), handwoven textiles; Cacaopera (Morazán), hammocks, ropes, bags of henequin; Ilobasco (Cabanas), pottery, dolls, toys; Sonsonate (Sonsonate), cream cheeses, milk, butter; and Cojute-

FIGURE 6.—Cotton Textile Factory in the outskirts of San Salvador, El Salvador, modest and pioneering in its aspect, significant in its promise.

peque, cigars, smoked sausages and tongues.

A specific example follows. Located on the outskirts of San Salvador is a fair sized cotton factory run by a family of Armenian extraction (Figure 6). Their finished products (with a name brand) such as cloth, thread and cheap stockings are manufactured mostly for a home market but some are exported to Honduras and more could be sold there if manufacturing facilities were available. The machinery came principally from the United States—Whitinsville, Massachusetts and Pawtucket, Rhode Island—with a few odd pieces from England, France and Germany. The company definitely plans to expand in the future but is quite concerned about the possibility of obtaining machinery.

The government has come to the assistance of the manufacturer in a considerable measure as it did for the farmer. Industry has benefited from special concessions, tax exemptions and protection from foreign competition. Among the beneficiaries may be noted especially the flour, hemp, hat, soap, salt, textile, match, mining and liquor industries. El Salvador is trying to establish coöperatives, which were initiated in 1940. One coöperative, a hat factory, has been started and has been proving itself most worth while. Others are being planned and studied and much hope is held out for them. In 1942—43 several new semi-public corporations were established to promote the social and economic improvement of the country but obstacles to be faced in expansion are lack of raw materials, skilled labor, fuel and a stable market.

Very little coal is needed, except as auxiliary power, for most of the power is hydroelectricity. Water power resources have hardly been touched for only some 2700 H.P. have been developed out of a calculated possible 300,000 H.P. At the dedication of the Cuscatlán Bridge in 1942 the President announced plans for construction of an hydroelectric plant on the upper reaches of the Lempa River to provide electric light and power for the entire country. Some plants and railroads use diesel engines which means that oil must be imported from Mexico, the Caribbean region or Peru. In time of great difficulty cotton seed oil could be brought into use as there is a large cotton seed oil factory in San Salvador. Wood, in the form of charcoal, is used rather widely for cooking.

The highways still need much new construction work but El Salvador is justly proud of the fact that it was the first republic between Panama and the United States to finish its section of 181 miles of the Pan-American Highway and this done, in the main, with its own funds. On June 6, 1942 the Cuscatlán Bridge over the Lempa River, the largest suspension bridge on the direct route of the Pan-American Highway in either North or South America, was dedicated by the President. With a total of some 3700 miles of highway, it may be said that 1600 miles constitute improved mileage.

Two railroad companies serve the territory. The Salvador Railway Company, Limited, owned by United Kingdom interests, connects Acajutla with San Salvador and Santa Ana and controls 90 miles of trackage in this coffee district. The Ferrocarriles Internacionales de Centro América, often identified by its anglicized abbreviation I. R. C. A. has the backing of the United Fruit Company and serves a large area of the country with its 285 miles. This railroad, which gives the country access to Zacapa and Puerto Barrios, Guatemala, first opened its lines to general traffic in 1930. In 1943 the railroads

carried 1,934,916 passengers and 523,312 tons of merchandise freight.

Air transport has quickened in interest in this small country as in the larger countries with almost a doubling of passenger travel from 1940–1943 in which latter year 4968 passengers entered while 4393 left. Americans had a somewhat larger registration than Hondurans, the latter with 3992 and the former 5843. Two airlines, the Pan-American Airways and the Compañia de Transportes Aéreos Centro Americas (TACA) sponsor the air service.

El Salvador claims five ports, La Concordia, El Triunfo, Acajutla, La Libertad and La Unión but the last three account for practically all of the shipping trade. Acajutla and La Libertad suffer from being open roadsteads as compared to La Unión which has a well-protected seaport. All three are connected by rail with the capital. In 1940 the government acquired a pier at La Libertad, the seaport for the capital. As of 1943 La Unión registered 175 boats, La Libertad 61 and Acajutla 21. La Unión ranked first in both export and import tonnage with La Libertad second in imports but Acajutla second in exports as might well be expected because of the coffee trade. Relatively few passengers use the ports other than La Libertad, again understandable because El Salvador far outstrips any other city as a business center. Although American ships do not come in large numbers, because of their greater carrying capacity they carry a large per cent of the exports and imports.

El Salvador does not rank as a large trade nation either in total value or in per capita value or volume but the fluctuations of trade from good to bad play a vital part in its economy. In general, exports exceed imports and 1943 was no exception to this rule when the differential amounted to about 26½ million colones (approximately 10 million dollars). The United States has been an important country in trade deals and of recent years has become even more consequential, accounting for an increasing percentage share. Competition from the United Kingdom and

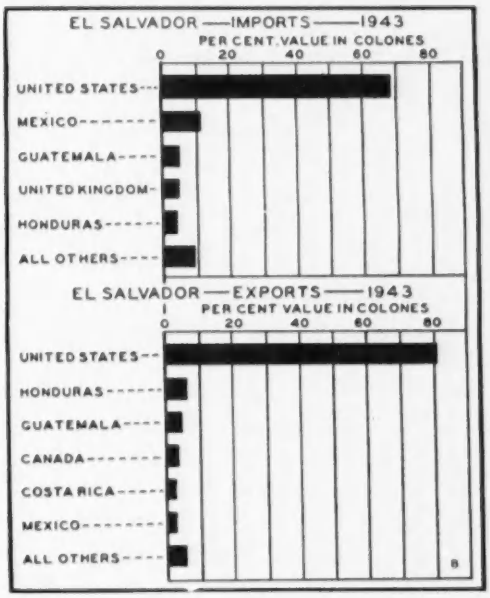


FIGURE 7.—Countries for exports and imports of El Salvador in year 1943. The preponderant, almost monopolistic, place of the United States in the country's foreign trade has far-flung implications.

Germany has been keen and especially during the years 1934–1938 Germany was winning more and more of the market with its discount policies and the use of the aski mark. El Salvador ran into considerable trouble in 1940 when it lost its European markets and the United States was not carrying on much purchasing. As an aftermath of the disruptions in regular trade channels more trade with surrounding countries has been tried and it is to be hoped that this will be not only continued but also encouraged for future development (Figure 7).

The country represents a non-industrial regional trade type with the export

of raw materials and the import of manufactured goods. Coffee constitutes by far the most important item with gold, sugar, balsam, henequin, cotton, rice, cattle and indigo of much less significance and of varying value. Textiles, including cotton, linen, wool, silk and artificial silk, lead the list of imports which also includes chemicals and pharmaceuticals, arms and ammunition, machines, automobiles, wearing apparel, wheat and wheat flour and paper, cardboard manufactures. In the future there is no reason to believe that such articles of trade will be greatly altered in proportionate value or in different types by the introduction of new products.

El Salvador has shown much consciousness of its major problems concerning land and peoples. The rather numerous small landowners have helped the nation become land minded and to be instilled with desire to improve their status. High regard for the social welfare of the general public, as well as their own workers, has steered some of the wealthy landowners into establishing medical and dental clinics and other social services as in one case at a coffee beneficio, a day nursery which might well be used as a model throughout the world.

With such large proportion of the land already under cultivation, expanded production will come primarily from improvement in techniques of agriculture. Realization in this respect will certainly come from the Cooperative Agricultural Experiment Station in El Salvador where experiments on rubber, fibers, medicinal plants, vegetable oils and insecticides along with many other items affecting tropical agriculture are being scientifically studied.

El Salvador offers much to students of the Latin America area. Its experiments, solutions and answers to many of the complexities of tropical economic and social life, though far from perfect, provide a definite pattern for study. With such knowledge as a basis, suggestions and designs for future development and improvement contain intrinsic values for casting success.

NORTH CAROLINA FLATWOODS

Samuel T. Emory

THOUGH it was the site of the first English settlement within the present United States, and though it lies within overnight haul of New York, the North Carolina Flatwoods region is still a frontier. After more than three centuries of European occupance, it was still, in our national economy, almost unknown to the country at large, until the recent war brought thousands of men from all parts of the nation to the Flatwoods for training, because the area afforded an almost unoccupied terrain of varied and difficult strategic, logistic, and tactical problems.

A Neglected Regional and National Resource

The Flatwoods region is an area of conspicuously under-developed resources. Though it has very large acreages of potentially productive farm lands, it is at present thinly settled and largely uncleared. It is mainly forest, but forestry practices are relatively inefficient and forest production is low. It is appraised by some fisheries experts as potentially the greatest producer of sea foods in the United States, but its fishing grounds and fisheries are on the whole poorly developed, and its present production of sea foods is not nationally important. It has an excellent system of inland waterways and a long frontage on the Atlantic Ocean, but its water communications are not well organized and its water traffic is relatively unimportant. It has hundreds of miles of beautiful sand beaches, but access to the beaches is quite difficult except at two points, and most of the coastline is virtually unoccupied.

Drainage Versus Irrigation. There is reason, of course, for three centuries of neglect. The reason is inadequate drainage. Most of the Flatwoods is swamp or semi-swamp, with fairly large marginal tracts of slow-draining land and only small percentage of land adequately drained. As a people, we are afraid of swamps, and we have not learned what to do with slow-draining land. We have preferred to learn irrigation rather than drainage. Our Federal Government, seeking new farm lands to replace marginal and submarginal tracts now being returned to forest, still sets its face toward the west and is now spending hundreds of millions of dollars to develop farms in the arid and semi-arid western states. The Flatwoods Area is worthy of study in comparison with irrigable western lands. Particularly is it worthy of study as a potential resettlement region for southern farm families forced off their homesteads by soil erosion and consequent reversion of farm lands to public forest.

Location and Extent

The "Flatwoods" or "Outer Coastal Plain" is the easternmost and lowest of the generally recognized physiographic provinces of North Carolina. The state cuts across the grain of the eastern United States for some 500 miles from east to west, running inland from the Atlantic Ocean well across the Blue Ridge and into the drainage basin of the Mississippi. The high western end of the state is known as the "Mountain Re-

gion," a land of steep slopes and narrow valleys. The middle section is the well-known rolling Piedmont Plain. The eastern section as a whole is known as the Coastal Plain, but it is divided, generally though rather vaguely, into two sub-regions. The inland strip of lowland adjacent to the Piedmont is known as the "Inner Coastal Plain," and the belt of lowland between this inner belt and the sea is the "Outer Coastal Plain" or the "Flatwoods."

The Flatwoods Area with an east-west breadth of between 40 and 70 miles, extends along the entire sea front of North Carolina, a distance of some 250 miles. As delimited in this paper, it has an area of 12,243 square miles, of which 8,858 square miles are classified as land and 3,385 square miles as inland water. The land area is greater than that of New Hampshire and the inland waters have three-fourths the area of Connecticut.

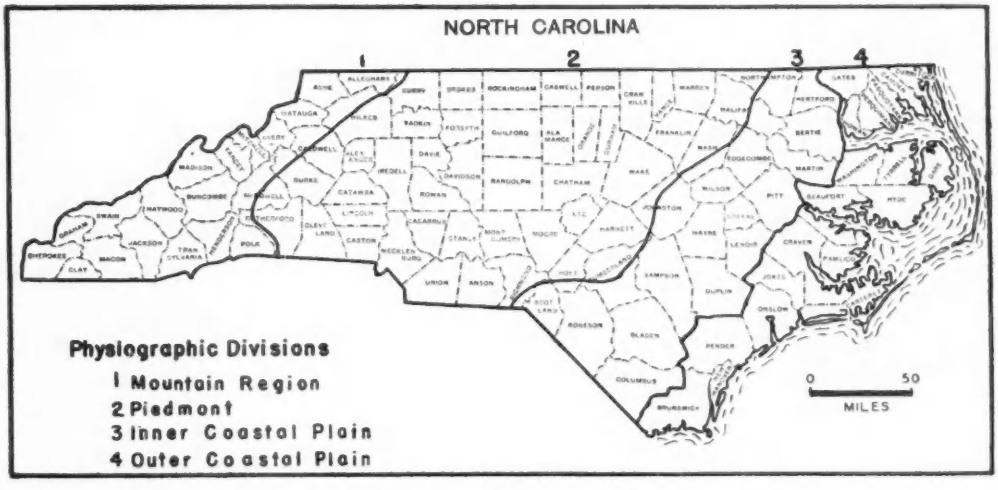


FIGURE 1.—Physiographic divisions of North Carolina. They are arbitrary in that each line of division represents a zone of transition. The physiographic regions of North Carolina are quite different one from another, but there are no sharp lines of division between them.

BOUNDARIES

The northern and southern boundaries of the Flatwoods as set forth here are purely arbitrary, being merely the state boundaries to the north and south. Actually, the North Carolina Flatwoods is only a segment of a more or less homogeneous sub-region stretching from New Jersey to Florida and called by various names in the several states which contain it. It borders the Atlantic Ocean, its eastern boundary, not an exact boundary can be set on the west. The difference between the Flatwoods and the Inner Coastal Plain lies fundamentally in drainage—and the difference is real, important, and apparent to the eye. On the whole, the Inner Coastal Plain is adequately drained and the Flatwoods is inadequately drained. There is no sharp line of demarkation between the two sub-regions, however, and it is hard to draw even a zone of transition, because there are considerable areas of poor drainage in the Inner Coastal Plain and there are islands and peninsulas of adequate drainage far out into the Flatwoods. Since any boundary is arbitrary, the Flatwoods Area is taken in this paper to consist of 19 counties which lie quite definitely within

the region of inadequate drainage. A considerable area to the west might legitimately be added.

THE NATURAL ENVIRONMENT

Climate. The Flatwoods Area has a long frost-free season and heavy, well-distributed precipitation. It is adjacent to the Atlantic Ocean, with the Gulf Stream only a few miles offshore, and no part of it is very far from either the ocean or broad inland waters; consequently, winters are mild, though severe cold waves in the country at large may bring short periods of freezing weather to even this coastal area. The frost-free period ranges from 218 to 270 days, and such hardy crops as lettuce, turnip sallet, broccoli, etc. are grown out of doors throughout the year. Summer weather begins early and lasts late, with much hot, humid weather except next to the water. Snow is not unknown, but it seldom endures for more than a few hours. The soil seldom freezes. Average annual rainfall ranges from 49.74 inches to 56.79 inches in various parts of the Flatwoods, with a summer maximum. Drouth is uncommon: the country is more liable to damage from too much rain rather than too little.

Hurricanes pass along the coast in late summer and early fall, but as a rule do little damage; partly because most of them pass a few miles offshore and partly, perhaps, because the country is largely forested and the storm winds are checked as they pass over land. The hurricanes bring high winds, however, and torrential rains, and occasionally they do serious damage to standing crops and to seashore settlements.

Topography and Drainage. The poor drainage so fundamental in the economy of the Flatwoods is due partly to the geological youth of the area and partly to its topography. The section was recently part of the sea floor and a thick blanket of sand was spread evenly over its surface by tide and current to form an almost level, sandy plain when ocean waters receded and left it exposed as a belt of new coastal plain. Rivers cut their way across the new land to the sea, carving broad and shallow, but well defined, valleys in the unconsolidated sediments. Later, the ocean encroached on the land again and the lower valleys were drowned to form broad estuaries reaching completely across the Flatwoods. Waves and currents then built up barrier beaches offshore along the entire coast, blocking the rivers from direct access to the sea and forming a series of shallow sounds between the barrier beaches and the mainland. The estuaries and sounds are now silting up with sediments brought from up-country by the streams, with the result that they

FIGURE 2.—Inland waters and poorly drained areas of the Flatwoods. Only the very large areas of poor drainage are shown. Each stream has considerable swamps along its upper course, and many small swamps and marshes are scattered about in areas shown here as generally well drained.

The dotted line indicates the course of the Intracoastal Waterway. Principal towns are indicated by numbers: 1, Elizabeth City; 2, Edenton; 3, Washington; 4, New Bern; 5, Morehead City; 6, Beaufort; 7, Wilmington.

have many shoals and sandbars and are fringed by swamps and marshes, though serpentine channels of deeper water are kept open by the waters of the rivers and by tidal currents.

The entire Flatwoods Area is semi-aquatic. The land is low, reaching nowhere an elevation greater than 80 feet above sea level; and since its western limit about coincides with the heads of the several estuaries, it consists of a series of broad, low peninsulas, the northernmost lying half in Virginia and the southernmost lying half in South Carolina, while four lie wholly in North Carolina.

These peninsulas, with their flanking sounds, estuaries, marshes, and swamps, form a truly amphibious domain, for the peninsulas themselves are for much of the year composed about as much of water as of dry land. The surface is so nearly level and so sandy that streams have not been able, in the short time since this land appeared above water, to establish complete drainage systems. Short tributaries at right angles to the estuaries drain small areas back into the peninsulas, but there are large discontinuous swamps and semi-swamps along the inter-stream divides. The upland swamps—they characteristically occupy the highest part of the peninsula—are known locally as "pocosins," "savannas," and "bays." The names are not clear-cut, and all three names may be applied to the same feature, all three indicating bodies of land which for a part of the year is covered by water. In addition to great upland swamps and semi-swamps, lowland swamps are scattered along margins of the estuaries, and marshes fringe seaward ends of the peninsulas. Thus, even the mainland is formed of low peninsulas, each with a broad core of undrained land and each with a fringe of swamp and marsh. The peninsulas are separated from each other by wide estuaries merging into sounds. They are bordered seaward by a long and continuous line of sounds, wide at the north and narrower toward the south. Beyond the sounds lie barrier beaches which form the Atlantic coast.

FIGURE 3.—Currituck Sound, a medium-sized far northeast extension of the Flatwoods waters offers excellent duck shooting and fishing. (Courtesy of N. C. State News Bureau.)

Forest Cover. Roughly three-fourths of the Flatwoods Area is forested, mostly in second-growth pine, inferior to the original pine forest. Pond pine dominates in poorly drained uplands, growing in thin stands with undergrowth of scrub and tall grasses. Loblolly pine, with some scattered stands of long-leaf pine, occupies such parts of the well drained land as are still uncleared. Lowland swamps along the streams, and some of the upland swamps, are stocked with cypress and such hard-

woods as red maple and black, red, and tupelo gum. There are considerable areas of marshland where eastern extremities of the peninsulas merge into shallow margins of the sounds.

Most of the timber is under saw-log size, particularly pond pine and longleaf stands, for it is regrowth of timber after heavy cutting. The forest is restocking, in spite of continued cutting and frequent forest fires, producing sawlogs in from 30 to 60 years. It is understocked at present, but the State Forester reports that increment exceeds drain on the pine, is about even with the drain on swamp hardwoods, and is less than the drain only in cypress stands.

Soils. All Flatwoods soils are formed from much the same material—unconsolidated sediments of the former sea floor, and they were formed in essentially similar climatic conditions. Their differences are mainly the result of differences in drainage conditions under which they were formed.

FIGURE 4.—Northeast Branch of the Cape Fear River. Such quiet streams offer water transportation throughout the Flatwoods. Forested swamps along shore were once used for rice cultivation. The second bottoms parallel the streams, separated from them in most places by swampy first bottoms ranging in width from a few hundred yards to several miles. Towns are built at places where the stream has bluff shores and the second bottom is immediately adjacent to the channel.

The river-side swamps along the upper estuaries have no proper soil profiles and are classified simply as "swamp." They are floored with sediments brought down by streams and are full of organic matter. They are known locally as "first bottoms" because they lie immediately adjacent to streams in parts of broad valley trenches cut by the streams but not now occupied by them except at flood. The first bottom is likely to end on the land side in a low bluff marking the edge of the valley trench; at the top of the bluff lies the "second bottom." Second bottoms are strips, islands, and ribbons of land high enough to be free of flood and close enough to streams to have achieved drainage. Where the river occupies the entire valley trench, there is no first bottom, and the second bottom is adjacent to the water at the top of a sharp rise of from four or five feet to perhaps twenty feet. The second bottom has a definite soil profile and in general belongs to the Norfolk group.

Farther back from the streams are lands slightly higher than the second bottoms but farther from master drainage channels. They represent a transition zone between adequately drained second bottoms and poorly drained lands still farther inland, and their soils belong in general to the somewhat acid Portsmouth group. Inland from the Portsmouth soils, somewhat higher and somewhat farther from master streams, lie upland swamps and semi-swamps, floored with several feet of muck and peat laid down over sands. In some instances hardpan has formed at considerable depth below the surface, made up of sand grains cemented together by soluble minerals dissolved from the soil by percolating water and re-deposited at the level of ground water.

Here and there in the Flatwoods are isolated ridges and islands of well-drained sands lying somewhat above the general level—apparently fossil

beach lines remnant from the distant past. Similar beach lines, with sand dunes well developed, are found in places along estuary and sound shores, and barrier islands east of the sounds are hardly more than long lines of sand dunes. They have, of course, no proper soil profiles, and are classified simply as "coastal sands."

All such soils are sandy, light and easy to work. They are thoroughly leached and are highly pervious.

PRESENT DEVELOPMENT

The First Bottoms. The first bottoms —flood lands along the upper estuaries— are forest lands at present and incidentally hunting and fishing preserves. With one partial and temporary exception, they have fulfilled such a function since early colonial times, serving as self-renewing reservoirs of cypress and hardwoods and refuge for deer and bear, and for such lesser denizens of the forest as the raccoon, opossum, and muskrat. The temporary exception was rice cultivation, actively carried on in the southern counties of the North Carolina Flatwoods in late colonial times and pushing northward into the northern counties just prior to the War between the States. The first bottoms were almost ideal for wet rice, since they are naturally flooded with fresh water during the rainy summers of the region and are likely—though by no means certain—to be dry in the fall, when rainfall is usually light and streams are low. The first bottoms were highly prized by rice planters and in places were developed and intensively cultivated; but increased competition, labor difficulties, and general break-up of the plantation system after the war, eliminated rice almost completely from the Flatwoods, and former rice fields have reverted to forest.

The Second Bottoms. The second bottoms include practically all present development in the Flatwoods Area. The well-drained Norfolk type soils are light and easily worked, quick to drain and warm up in spring. They are thoroughly leached of soluble minerals, since the material was laid down under water and since their porous, sandy composition permits the heavy rainfall of the area to percolate deeply and readily into the soil. This soil deficiency is readily met, however, by applying commercial fertilizers of which the proportions have been worked out by long experience and of which annual use is accepted as a normal state of things by farmers of the region. Second bottoms produce good crops of bright tobacco, various truck crops, peanuts in the northern counties, some cotton, and such subsistence crops as corn and soy beans. Land of the second bottoms is largely cleared and cultivated, farms are small, and farm population rather dense.

FIGURE 5.—A pocosin on the divide between New River and the Northeast Branch of Cape Fear. This particular complex of pocosin, swamp, savanna and bays measures some 25 miles by 15 miles. The area shown is fairly typical pocosin, with pond pine, scrub and tall grass cover. Water stands over the area during wet seasons. (Courtesy of the N. C. State News Bureau.)

Roads and railways tend to run along the second bottoms, partly because farms and people are there and partly because there are fewest obstructions to traffic. There, too, are rural schools and churches, and there villages and towns have developed. The second bottom is a mere ribbon of cultivation, however, in a great, encompassing wilderness. The forest marches with it on the inland side, never out of sight, and on the outer side is either broad water, swamp forest, or marshland.

The Debatable Zone. Up-slope from the second bottoms and parallel to them lie belts of slow-draining land. Short tributary streams are working out a drainage pattern for them, but progress is very slow in such land as this, where very gentle slope gives them but little power and where deep sands absorb rainwater and allow it to seep down into the earth rather than flow away on the surface. Drainage on the whole is too slow for formation of Norfolk soils, and the somewhat acid Portsmouth group is dominant. Such soil is potentially good corn, potato, and soy bean land and adapted to certain acid-tolerant truck crops. It needs artificial drainage for agricultural use, as well as commercial fertilizers required by most southeastern soils. Some of the transition zone between the well drained and the poorly drained parts of the Flatwoods has been improved and is now producing good crops; on the whole, however, it is in forest, chiefly of better varieties of pine; it tends to form the back acreage of farms of which cultivated frontage along the roads is on Norfolk type soils. It tends to be a debatable zone, partly fields but mainly wood lots, between generally cultivated first bottoms and pocosins farther inland.

Soils experts and local farmers agree that most of the zone, could, and should, be added to present crop lands by rather easy drainage operations. Drainage must be on a large scale, however, and according to a complete engineering plan; for the areas to be drained are interdependent, drainage ways through cultivated second bottoms are involved, and channel clearance in the estuaries is required because of the very slight gradient in the main streams. Engineering study and a general plan are prerequisite and authority to act over a wide area. Further, more capital is needed than the area in itself can afford.

FIGURE 6.—Lake Mattamuskeet. A large shallow lake which was drained by pumping and has been allowed to fill again. The bed of this lake was an acid, peaty soil. It was set in wheat and failed, the humid climate causing serious rust damage. This development is one of the much argued projects, some informed persons holding that it could succeed under proper management, others considering it a strong argument against drainage of swamp lands of the interior. (Courtesy of the N. C. State News Bureau.)

The Upland Swamps. Inland from the debtable belt of slow-draining, acid soils of the Portsmouth family lies the level divide area, with its several types of poorly drained lands. Some of the poorly drained areas, known usually as pocosins or savannas, are merely slight depressions in the upland surface, or even level areas, which have not yet established drainage. They are analogous to the mud puddles which stand on any level surface after a heavy rain. Where hardpan lies near the surface downward movement of rainwater is checked and

the water stands for a time, until it can escape by horizontal seepage or evaporation. Temporary ponds and lakes form during rainy weather and disappear during long dry seasons. Pond pine is tolerant of this periodic flooding and forms characteristic pocosin cover, growing in thin stands of poor quality, with undergrowth of scrub and tall grasses. Grasses burn readily in dry weather and pocosins are ravaged by frequent forest fires.

Pocosins are of little value at present except as game refuge. The tall grasses afford a little poor pasture for a few weeks after being burned, and support a few scrub cattle which supplement their grazing with rushes growing in damp spots and with browse from shrubs. Pond pine supplies firewood and some small timber. The land has been cleared, drained, and cultivated in a few places, with varying success. Some farm experts think that feasible drainage will make pocosins satisfactory farm lands, but the matter is in dispute at present and evidence can be offered both to support or refute their opinion. It seems quite likely that pocosins, though surficially quite similar to each other, have varied potentialities as farm lands.

In addition to shallow pocosin and savanna areas, there are hundreds of depressions of a different type scattered over the entire Flatwoods. These depressions vary in size and depth, but they are invariably of an oval shape. They are usually termed "bays," though the loose terms "pocosin" or "savanna" are sometimes used, and they are usually deeper than the typical pocosin and more likely to resemble true swamp than either pocosin or savanna. Some bays have been drained and are acceptable farm lands; most of them, however, are grown up in a jungle of swamp shrubs, vines, and water-loving trees. They have been attributed by various authorities to the action of a swarm of meteorites, to solution, and to a combination of the two. Since their origin is not within the field of this paper, it will suffice to say that the potentialities of the bays are quite varied, some of them lying in such positions as to make their drainage quite feasible and some of them being drainable only by extensive works and steady pumping. Their soils are varied, most of them having a floor of peaty material or muck, but some of them being quite sandy. It would seem that each bay should be studied separately as to its potentialities for agriculture and as to difficulty of preparing it for farm use.

The Barrier Beaches. Barrier beaches are potential recreation grounds, rather than farm lands. Their seaward border lies in long strips of gently shelving, smooth, sand beach, broken by irregularly spaced tidal inlets. Their bulk is a narrow backbone of sand dunes, fixed or wandering, and their sound-side is bordered with salt marshes. They were originally forested in pine, but much of the forest has disappeared, and the "banks," as they are locally named, are in the main clothed by only such scrub as myrtle, and tall, sand-resistant grasses. Their width varies between a few hundred yards and, perhaps, twelve miles, and their total length from north to south is some 300 miles. They offer many miles of attractive beach and dune, with surf bathing on the ocean side and quiet waters for swimming and boating on the sound side. There is excellent fishing offshore and at the inlets, where such sport fish as the drum and amberjack are taken in great numbers. Offshore waters and sounds are rich in such food fish as sheepshead, mackerel, trout, bluefish, flounders and "croakers"; and the

sounds afford duck and goose shooting, as well.

The barrier beaches are little used as resorts except near Wilmington and the twin cities of Beaufort and Morehead City, though a third center is developing at Nag's Head, northward, and a number of small developments taking form at other places along the coast. The three localities named as resort centers are the only places at which access to the beaches is even moderately easy. Railways and highways reach the coast at Wilmington and at Beaufort-Morehead City, and highways give roundabout access to Nag's Head. Except in the three areas, the sound separates the barrier beach from the mainland, and there is no effective method of crossing. Difficulty of crossing the sounds has been accentuated seriously by dredging of the Intracoastal Waterway; for bridges across the waterway must be manned drawbridges so constructed as not to interfere with navigation. It would seem reasonable to consider it a Federal obligation to maintain bridges or ferries across the barrier at strategic points, particularly during summer months.

FIGURE 7.—A herd of fine cattle at Ivershiel, near Wilmington. The owner has developed practically year-round grazing for cattle on slow draining lands. He has also drained pocosin successfully, settling Dutch immigrants on his developments.

The Inland Waters. Not least among resources of the Flatwoods are the 3,500 square miles of inland waters—Currituck Sound at the north, joined by Albemarle Sound next to the south, then Pamlico Sound and a series of narrower sounds running all the way to the South Carolina line. These quiet sounds, sheltered from the sea by almost unbroken barrier beaches and fed by large rivers, offer opportunity for enormous production of oysters and scallops. Shad, rockfish, and herring pass through the sounds and up the estuaries in great "runs" to interior breeding waters, and such food fish as flounder, bluefish, trout, and others abound. The shellfish industry is not well developed, partly because the sounds are comparatively distant from large markets; only recently has it been possible to transport shell-fish over the long distances entailed and with the slow transportation available. Shad, rockfish, and herring fisheries have operated here since colonial times, and they still operate on a rather small scale, selling shad and rockfish fresh, and corning the herring. Apparently the shad and rockfish have been overfished seriously, for the present take falls far below fabulous tonnages

reported from earlier times. Commercial fishing is not a major industry in the Flatwoods at present, the *Census* of 1940 listing only 2,600 males as fishermen. There is considerable part-time fishing, however, and fish play a large part in the subsistence economy of the area.

A special branch of fisheries in the sounds and in off-shore waters is menhaden fishing. The menhaden is a small, bony fish akin to the shad, with a fatal habit of congregating in large schools in shallow water. The schools are sought in large power boats and are taken in pound nets and sold to "fish factories," which, located in some marshland remote from towns, render their vile smelling prey, sell the fish oil, and make the residue into "fish scrap" fertilizer. There is no proved reduction in the number of menhaden, though the catch varies greatly from one year to another.

Port Possibilities. The port possibilities of the long Flatwoods ocean front seem to be rather well developed in view of the serious natural handicaps to port development on this coast. The best known of these handicaps is the low, sandy, and notoriously dangerous coastline. Cape Fear, Cape Lookout, and Cape Hatteras are spaced along the southern two-thirds of the shore, and, though the northern third has no famous cape, it is a continuous sandbar, broken by few inlets and with shoals far offshore. The dangers of the coast are known to seafaring men throughout the commercial world, but it is likely that the terrors of the capes are much exaggerated today. The shoals are well marked and channels have been dredged through them at several points to offer reasonably safe ingress; notably at the mouth of the Cape Fear River, well to the south, and at the twin towns of Beaufort and Morehead City, near the center.

The most serious barrier to port development here is a twofold restriction of the hinterland from which the Flatwoods ports must draw their subsistence, plus the fact that the small hinterland to which they are restricted by nature is not highly productive of sea trade. The back country is restricted first by the fact that the Blue Ridge Mountains reach their highest elevation in western North Carolina and stand as a great wall across the western approaches of the state—a broad zone of rough highland without any easy passes. Traffic from west of the Blue Ridge tends to flow either north or south of North Carolina, thus restricting the ports essentially to the traffic of their own state. The second restriction is the outward bulge of the North Carolina coast. The convexity of the coast places the greater part of

FIGURE 8.—Surf fishing at Cape Hatteras. There are many miles of such beach as this along the shores of the offshore "banks," mostly inaccessible except by long and costly routes. The beaches should be made into public playgrounds.

even North Carolina about as close to either Charleston or Norfolk as to Wilmington, and leaves only a few counties closer to Morehead City–Beaufort than to some other port. The effective hinterland of the North Carolina ports thus consists of only a part of one state, and that part chiefly in the eastern area—an area definitely agricultural and devoted to high-priced, "hurry-up" crops such as bright tobacco and truck.

Inland Waterways. The Flatwoods Area is better blessed in its inland waterways than in its sea connections. A segment of the Intracoastal Waterway cuts across the peninsulas and estuaries from the northern to the southern borders of the state, and the sounds, with channels improved by the Federal Government, offer an alternative route farther east; the estuaries, with dredged channels, cut across the two north-south routes and offer east-west waterways across the Flatwoods. Thus, there are two north-south waterways, both continuing far beyond the Flatwoods, and there are five lateral lines, rather evenly spaced. In addition, a large number of small creeks and bays cut into the margins of the land. The result is that there is hardly a spot in the entire area more than 20 miles from water navigable for small craft.

The waterways net is little used, as compared with potential use. Fishing boats and pleasure craft make up most of the traffic, though small river tankers and an occasional barge pass along, and there is some rafting of pulp wood.

Urban Development. The Flatwoods is not a city building area. The largest city is Wilmington, with a 1939 population of 33,407; New Bern and Elizabeth City have approximatly 12,000 people each; Washington ("The Original Washington") has some 8,500 population; and Edenton, Beaufort, and Morehead City fall in the 3,000–3,500 population group. One-fourth the population lives in the towns of 3,000 or more, and there are a number of smaller towns and villages.

Flatwoods towns are fresh-water towns, with exception of salt-water Wilmington and the Beaufort-Morehead City twins. Their sites were chosen by water-minded men, and their early development was closely tied to the sounds and estuaries on which they occupy strategic sites. The waterways which located them have played a less and less important role, however, as land transportation has developed and water transportation has declined. The old commercial centers were the blocks adjacent to the water, and traffic feeder lines from nearby land areas focused here on the main line of water transportation. Now the waterside blocks are dead ends, lined with crumbling old brick structures used for storage and with a few ramshackle fish houses on the water front. The business centers of the towns have moved away from the dockside to higher ground a few blocks back on which highways focus the dominant land traffic of today.

However, the strategy of location which chose and developed the old water town sites holds, with minor shifts, for the land traffic town of the present, and chief towns of late colonial times are chief towns of today. The strategic water sites were the heads of estuaries and bays, and these locations are equally strategic in the later-developed land transportation pattern. The land routes tend to follow the river to the head of its estuary and there to fork and run down both sides of the estuary, thus making the old river town a focus of east-west traffic; the north-south land routes cut across the head of the estuary at the last narrow crossing place. Thus the old town is a focus of railway and highway traffic for its vicinity by virtue of its water location. Further, most

of the old towns are county seats, and the North Carolina highway legislation provides that each county seat shall be connected by highway with every other county seat. The old towns, therefore, received additional highways as a secondary blessing of their original location. All of them are essentially trading and service centers for their respective areas. Wilmington has in addition a super-trade and super-service function for a large part of southeastern North Carolina and is, further, a port of some importance. Beaufort and Morehead City have a distinct flavor of the sea, largely through resort and fishing activities, but they too are fundamentally regional trade and service centers.

EMPLOYMENT IN THE FLATWOODS

An Agricultural Region. The people of the Flatwoods support themselves mainly by farming. The *Census* of 1940 shows a total of 74,147 regularly employed males in the area; and of the number 34,986, or approximately 47 per cent, are reported engaged in agriculture. Lumbering occupations such as sawmilling and work in planer mills make a poor second to farming, with 5,913 males, or approximately 8 per cent of the total. Clerical work of various types occupies about 7 per cent of the males, construction work occupies about 5 per cent, forestry and fishing together about 3½ per cent, and manufacturing, railway work, and the professions about 2½ per cent each.

Agriculture. Though almost half the people of the Flatwoods are farmers, most of the land is in forest. Less than 12 per cent of the total land area was harvested cropland in 1939, and only four of the 19 counties had as much as 50 per cent of their land area in farms. Further, approximately three-fifths of the farm land is farm woodland. The median Flatwoods dweller is a farmer in a great forest. He tills only a patch of clearing on his farm, typically the road frontage, and his woodland merges at the back of his farm into the great wooded marshes and swamps of the interior. His farm is too small for prosperity, with a median of 71.4 acres, and his cropland is inadequate, with an average of 29 acres per farm.

The woodland farmer follows the pattern of his state and region in his farm activities, placing most of his dependence on cultivated row crops and deriving 55 to 80 per cent of his income from them. Corn is easily king in acreage, with almost half the total harvested area, and soy beans second in acreage, with almost a third of the total. Acreage is not the true measure of agricultural importance in the Southeast, however, for the "money crops" rule in the farmer's interest and labor, though their acreage requirement is comparatively small. Tobacco is first among the Flatwoods money crops, whether rated on acreage, value, or labor requirement. Peanuts come second, Irish potatoes come third, and cotton fourth—all four money crops together occupying approximately one fourth of the harvested cropland, or about 3 per cent of the total land area.

Livestock is unimportant in the Flatwoods economy, only four counties in 1939 reporting as much as 20 per cent of the farmer's income from livestock and one of the four being an almost uninhabited swamp county. Truck farming is important in several counties, running to a third of the total farm income in the county containing the city of Wilmington and to approximately a tenth of the farm income in four other counties. Truck occupies only 3 per cent of the harvested farm land, however, and is not important in the area as a whole. Subsistence is not particularly high, a median by counties

for 1939 showing only 17.4 per cent of the farmer's income as lying in products consumed at home; only two counties ran higher than 25 per cent. Forest products, despite the large farm woodlands, are credited with only approximately 2 per cent of the farm income of the area.

Other Occupations. It seems remarkable that in the Flatwoods—a great forest surrounded by broad waters—less than 12 per cent of the men are concerned with forests and fisheries. Of this 12 per cent, two-thirds are engaged in lumbering activities well distributed over the area; planing mills being found in the towns and the sawmills moving from place to place as they exhaust small local stands of timber. The remaining third of the men concerned with forests and fisheries are made up of foresters, as distinguished from lumbermen, and fishermen. Fishermen in the group are heavily concentrated in Cartaret, the county containing Beaufort and Morehead City, though there are small groups of fishermen scattered along all the sound and ocean shores. Concentration in Cartaret and small development in other counties appears to be largely a matter of utilized opportunities in the one county and semi-accepted opportunities in the others.

Males engaged in manufacturing are heavily concentrated, with over half the total for pre-war years reported in Wilmington and Elizabeth City. War industry has probably not changed the proportions greatly, and, since there is every likelihood that war industries in this area are impermanent, it seems wise to consider manufacturing in prewar terms. On this basis it is possible to say that manufacturing, though concentrated in the towns, is an accessory to these towns rather than the reason for their existence; it is drawn to the towns by the concentration there of people and transportation, and it plays a minor role, on the whole, in the support of town populations. For example, in 1939, Craven County, seat of New Bern, had 947 males engaged in wholesale and retail trade and only 248 engaged in manufacturing; Beaufort County, seat of Washington, had 972 males engaged in trade and only 211 engaged in manufacturing; and even New Hanover County, seat of Wilmington, reported 2,306 males engaged in trade and 1,623 in manufacturing.

Most Flatwoods manufactures arise directly from the soil or the sea or minister directly to the land and people of the area. The most valuable manufacture is that of fertilizers, derived partly from the sea and needed for leached farm lands of the area. Factories are almost always located at the water front, for the materials either come by sea—as do nitrates, potash, phosphates, and sulphur—or they come from the sea in the form of fish-scrap. Wilmington is the chief fertilizer center, but all larger towns have fertilizer plants. There are two large pulp mills in the area, situated on rivers and using small timber, and several wood-working plants, aside from the numerous planer mills and saw mills. Another industry drawing its materials directly from the lands and waters of the area is a large bromine plant near Wilmington which extracts bromine from sea water.

There are a few cotton mills and shirt factories in the Flatwoods—a departure from pattern in that they are not closely associated with the products or needs of the area but are exploiting a favorable labor situation. It seems likely that there will be increase of such manufacturing enterprises, for there is a large body of poorly paid workers, transportation is adequate for this type of manufacture, and coal can be delivered cheaply along the waterfront. Textiles

in particular have shown tendency to expand toward the east.

Services of all kinds are, of course, concentrated in the towns, particularly in the larger towns. Wilmington alone has approximately one-fifth of the professional workers of the nineteen counties, both male and female. Wilmington has, too, the bulk of the railroad employees of the Flatwoods: the main offices of the Atlantic Coast Line Railway are located there, and 1,256 of Wilmington's 12,078 employed males work for the railway.

The Rewards of Labor. The rewards of labor are not high in the Flatwoods. Again disregarding the war employment of the present as being presumably temporary and taking 1939 statistics as being reasonably typical, the *Census* of 1940 shows more than half of the employed males engaged in agriculture. This large block of the working population is poorly paid. The *Census* of 1940 shows that 61 per cent of the farms reported less than $1,000 in "farm products sold, traded or used by farm households." The fact that from one-fourth to two-thirds of the farmers in the various counties are tenants further reduces the income of the man who actually tills the soil. The median value of farm homes, by counties, is $600, and one county median falls to $278. Woofter's "Agricultural Regions of the U. S. A." rates the area as "low" to "third lowest" in scale of living. The farms are inadequate to employment of their farm families, as is indicated by the fact that the *Census* of 1940 reports 28.1 per cent of farmers in the median county as working part of the time off their farms, the average time worked off the farm being approximately 106 days in a year. Many flatwoods farmers are part-time, supplementing by day labor the meager returns of their too-small farms.

The towns report the median value of urban and rural non-farm homes at only $805. Wages, as reported in the 1935 *Census of Business*, are at approximately half the national average.

Indications of low income and low living standards are supported, rather than qualified, by long acquaintance with the region. There are a number of well-to-do citizens in each town, and their living is generous and gracious; there are a few substantial farmers in the countryside; but for the great mass of men who work with their hands, whether in town or country, diet, housing, and clothing are far below national standards.

Under-development. The people of the Flatwoods are poor partly because they are under-paid and partly because they are under-employed; and fundamentally their poverty is the result of under-development of the resources of their region. The Flatwoods is, for its potentialities, under-populated; yet the present sparse population is inadequately employed, on farms too small to engage the full energies of their farm families and in industries only rudimentary in development. Fisheries offer only a few people real jobs, and forestry practices are backward. The trade and service establishments of the towns depend on the men of farms, fisheries, and forests more than upon the industries of the towns themselves, and they thus reflect the general under-development of the area. Better support for more people is possible, but it is dependent on better utilization of great under-exploited resources in land, in forest, in inland and off-shore waters, and to a degree in industrial resources.

POTENTIALITIES

Association. The potentialities of the Flatwoods must be viewed in association with the needs of neighboring areas if

they are to be seen in true perspective. The Flatwoods Area has large undeveloped acreages of potentially good farm lands which will not suffer from erosion—and close at hand lies the Piedmont Plain, in which erosion has destroyed much farm land and continues to take a terrible toll. Piedmont farm families are being driven from the farm by erosion, and they need a nearby place of refuge where their *mores* will not suffer too profound a shock and where their knowledge and skills can be put to good account. If the Federal or state government proposes to prepare homes for these people, will it not be better to prepare them, if possible, in the Flatwoods, rather than in the distant and strange environment of a western irrigation project?

The Flatwoods has large acreages of forest, much of which could be improved in stand and productivity and made into permanent timber farms—and this forest lies within a short haul of the great consuming centers of the Northeast. It has mild winters and an early spring, and soils well suited to truck farming—and it has this rich combination within easy trucking disitance of New York. It has a vast fish-producing area—and this area is within easy reach of great city markets. It has hundreds of miles of beautiful, lonely beaches—the nearest coastline to perhaps four million people. It has water transportation and a non-industrial population to offer industry—near the crowded industrial areas from which industry seems somewhat inclined to recoil.

The Fundamental Place of Drainage. Drainage is fundamental to improvement in almost every phase of the Flatwoods economy. Since half the population is agricultural and most of the nonagricultural half leans on the farmer, any measure that increases the prosperity and the numbers of farmers will increase the prosperity of the entire region. It is the opinion of the State Commissioner of Agriculture and of a number of agricultural experts that the Flatwoods farmer needs a farm of about 100 acres, half of it cleared and half of it in cared-for timber. This would mean doubling the present crop acreage; and such an increase could be attained only through drainage, for the land naturally well drained is already densely occupied. To care for additional farmers brought in from the Piedmont would entail still more drainage.

There seems to be enough drainable land to double, and probably to more

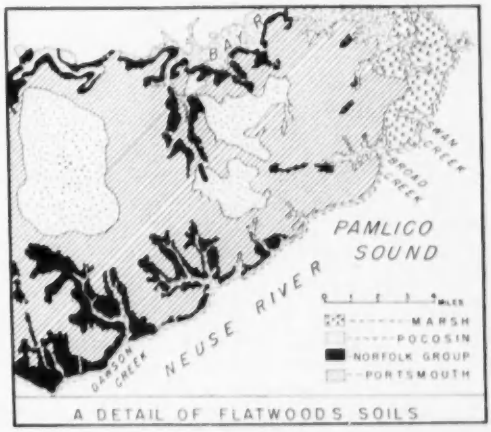


FIGURE 9.—A detail of Flatwoods Soils. The soils are classified here in four general groups: well drained Norfolk type soils, slow draining Portsmouth type soils, poorly drained upland soils (Pocosins), and marshlands. Note that well drained lands border the streams and that large areas of slow draining land lie immediately inland from the well drained strips.

than double, the present crop acreage. The various *Soil Survey* reports show a total of 1,089,907 acres classified as "well drained," and a total of 1,755,506 acres classified as "drainable." The reports have been issued over a considerable period of time, and they doubtless represent variations in judgment as to classification. It seems likely that they are on the whole conservative, but even if the estimate of drainable land be

cut in half there still remains almost enough drainable land to double the well drained land available at present. The magnitude of the undertaking may be better comprehended by comparing the acreages above with the total area of Delaware—1,317,000 acres.

Something over 2,000,000 acres is classified in the *Soil Survey* reports as undrainable. Foresters think it quite possible that the drainage of adjoining lands would make this vast remainder a better forest reserve than it is at present. Much of the pocosin now forested in pond pine might, in the opinion of some foresters, be improved by nearby drainage operations to the point at which it would support the far more valuable loblolly pine.

The Wildlife Phase. It is quite likely that any proposal to drain Flatwoods areas on a large scale would draw fire from hunters; and the hunter can point to some unfortunate drainage operations which have succeeded only in destroying game preserves, and to others of dubious value, including some in the Flatwoods Area itself. In rebuttal, figures from the *Census* of 1940 can be cited, showing that out of 825,576 acres in North Carolina drainage enterprises 673,034 acres were in occupied farms in 1939. Further, case studies of drainage enterprises thus far undertaken in the state seem to indicate, not that drained lands are unfit for agriculture, but that the drained lands require special techniques and that these techniques must be taught as a part of the drainage enterprise. In this connection it is interesting to note that some of the most successful development of drained lands in North Carolina has been carried out by Dutch immigrants.

The hunter should note, before protesting too vigorously, that some 2,000,000 acres of land are classified as "undrainable" or "drainage not feasible" in the various soil surveys. Approximately five-twelfths of the land area seems destined to remain swamp, marsh, or pocosin, and all of the 3,385 square miles of inland waters would be left unharmed by drainage. This is a land area about equal to that of Delaware and Rhode Island combined and a water area equal to nearly half of New Jersey. It would seem hardly reasonable to demand that a potentially productive farm area reserve more land and water than this for use as a game preserve.

A Federal Project. This area should be considered as a possible Federal project, if it be granted that Federal development of any section of the United States is desirable. This area should be considered in competition with irrigation projects in arid and semi-arid western states, and the following comparative advantages should be given due weight:

1. Cost of drainage is far below cost of irrigation if cost figures in the *Census* of 1940 can be taken as approximating future costs in both drainage and irrigation. Maintenance costs of drained lands are far lower than maintenance costs in irrigation projects, according to the same statistics. It should be pointed out, however, that most of the drainage thus far accomplished is probably in areas easily drained.
2. Flatwoods lands when drained will require fertilization; they will not, however, tend to become over-rich in soluble minerals.
3. Flatwoods lands will be practically free from erosion.
4. The climate of the Flatwoods invites production of truck crops, cotton, soy beans, corn, early potatoes, and peanuts. The short growing season and cool summer nights of most irrigated areas severely restrict crop choices and in many localities limit production to cheap produce and small per acre returns.
5. The Flatwoods lies within 300 to 400 miles of the nation's greatest food market, and it has inland waterways, railways, and highways ready for use. Western irrigated areas are far from market, and the route is in many cases difficult as well as long and requires construction of roads for considerable distances.
6. The area is within the homeland of many families forced off farms by erosion and, though farm practices in the lowlands should differ from those of rolling uplands, the change would be far less radical than

that from the Southeast to the semi-arid West.

7. Water farming is perfectly feasible in the Flatwoods as an adjunct to land farming, whether carried on by a separate group or as a part-time occupation of the farmers. Fish foods can add materially to the farm income.
8. Forestry and resort activities offer additional regional income, expanding local employment and local markets.
9. Further development of farm lands, fisheries, and forests will immediately benefit the towns of the area and supply raw materials for expansion in certain types of industry. Increased population and increased production in the general area will revive ports and increase traffic on inland waters.

Comprehensive Study Required. The area is one offering apparent promise of increased support for a large group of people, provided limited drainage operations are undertaken. The apparent promise has never been subjected to a broad, thorough, and impartial study. Such a study should be made, and if results warrant expenditure of Federal funds it should be followed by experimental drainage projects in carefully selected locations. If such experimental projects bear out the apparent promise of the region, the whole of the Outer Coastal Plain, from New Jersey to Florida, should be weighed in comparison with such Federal projects as the Columbia Basin enterprise, proposed developments in the Missouri Valley, and the partially accomplished reclamation of the Tennessee Valley.

In any comparison or evaluation of projects, it should be kept always in mind that the Outer Coastal Plain:

(a) Has one of the world's best growing climates,
(b) Has soils which do not erode.

PECAN INDUSTRY IN THE UNITED STATES

Isabel K. Billings

THE pecan tree and its fruit have become important factors in man's way of life in southern and southeastern United States. The pecan tree is native to much of the region, but not all. In its native habitat it has developed from an "on the spot" food for Indians, early explorers, and pioneers to the source of a significant industry, and in recent years the industry has spread to adjacent regions. (Figures 1 and 2.)

Beginnings of the industry were small scale with negligible alterations in patterns of life and landscape. Before 1900 wild nuts were gathered irregularly from time to time as convenience permitted, and were consumed at home or sold locally in conformity to a fluctuating market. Later, when inhabitants of the region began to realize that the nut crop might have permanent commercial value, they became planters as well as gatherers and consumers. With aid of express and mail orders, nuts were sold, first to peripheral areas in proximity to the producing regions, and later to large city markets in more distant regions.

When planting of improved varieties of trees became prevalent and pecan production began to take on characteristics of a productive industry, the pattern of life and the cultural landscape of the region were altered. Until that time, man's only interest was in nondescript, scattered pecan trees he found growing wild. Now he became interested in growing homogeneous, well-kept orchards, with real commercial value. As a result, the avocation of nut gathering became a vocation for many people of the area, and the pecan industry became firmly established.

Location of the Industry

The pecan tree is native to a region of southern United States, bordering the Gulf of Mexico and extending northward along the Mississippi valley to southwestern Wisconsin. From the Mississippi River, the belt of native pecan trees spreads much farther west than east, extending westward into eastern Kansas, Oklahoma, and Texas, where it reaches across the Rio Grande into northeastern Mexico. The limited eastward extent includes only western sections of states bordering the Mississippi; with the noteworthy exception of a small extension from Mississippi into the "Black Earth Belt" of Alabama. (Figure 1.)

It is significant that improved varieties of pecans have been developed commercially in states east of the native pecan belt, rather than in the western group of states where they are native, (Figures 2 and 3). In marked contrast to the usual practice of developing improved varieties of commercial products in regions where a plant thrives naturally. Illustrative of this fact is development of hybrid corn in the Corn Belt.

The belt of improved varieties of pecans extends from Mississippi to Virginia, along the eastern Gulf and South Atlantic Coastal Plains and includes portions of the adjacent lower Piedmont country. (Figure 2.) However, Texas, Oklahoma, Louisiana, and Arkansas, which are in the native belt, are becoming increasingly important

as producers of improved varieties. (Figures 4, 5, and 6.) The apparent anomaly of development of improved varieties outside the extent of the native pecan area presents a challenge which existing data do not seem to answer.

DISTRIBUTION PATTERNS OF PECAN GROVES AND ORCHARDS

The natural pattern of seedling pecan groves is well described as follows in United States Department of Agriculture, Bulletin No. 324, September, 1932. *An Economic Study of the Pecan Industry*, S. A. Jones and V. C. Childs et. al., P. 11.

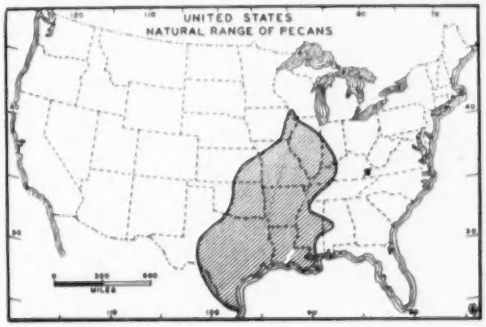


FIGURE 1.—Natural range of pecans in the United States.

Native groves in the western group of states, particularly in Texas and Oklahoma, commonly comprise the holdings of an individual along the course of a stream, and sometimes, in a broader forested area. The stand of timber is made up of varying proportions of pecans, interspersed with trees of other species. Single holdings may extend for many miles along a stream and its branches. Along larger streams, where lowlands spread widely from the watercourse, pecan trees may be scattered among the forest trees covering broad areas of the alluvial flood plains.

In Oklahoma, considerable interest has been shown by such landowners throughout the state, in improvement of the native groves. The improvement consists of clearing out all trees other than pecans, and in removing surplus pecan trees so that spacing of those remaining is 60 to 100 feet, according to Mr. Frank B. Case, head of Horticultural Department at Oklahoma Agricultural and Mechanical College, Stillwater, Oklahoma, in a personal letter to the writer.

East of the Mississippi, where most improved varieties are found, plantings vary from small family orchards to groves of many thousands of trees. Although small orchards are found on the Coastal Plain, the majority of plantings in that region are extensive. In the Piedmont section, however, most orchards are small. Although the large commercial orchard attracts attention of the investigator, large quantities of pecans are produced in the small family orchard, which is to be seen growing about many farmsteads much as apple orchards grow in other parts of the country. Nuts of the small orchards are grown partly for food, but they also supplement family income. Recognition of family orchards is necessary for a correct picture of the pattern of pecan orchards in southeastern United States.

The usual pattern of planted pecan orchard is that of a rectangle in which trees are evenly spaced in two directions

FIGURE 2.—Range of improved varieties of pecans in the United States, 1916.

at right angles in parallel rows. Such planting pattern allows easiest handling of cultivating and spraying equipment. Where intercropping prevails, rows of trees may be placed twice as far apart as trees in the rows; for example 30 by 60 feet, or 40 by 80 feet. The straight rows thus facilitate cultivation of intercrops.

Another pattern is that of contour planting on terraced land. It is probably least used, but should be done in many more cases, especially where land slopes 3 per cent or more.

In majority of cases, pecans are one of several crops grown on a farm unit, although in some places the entire acreage is in pecans. Cultivation of other crops is carried on as intercropping, especially while orchards are young. Cotton, corn, and peanuts are planted most often as intercrops. However, on other farms, the same crops are grown in separate fields, and areas between rows of pecan trees are used for growth of leguminous cover crops.

PRODUCTION PRACTICES

Pecan trees thrive on rich, fertile, alluvial soils, which contain abundance of humus, retain moisture, but are well drained. Although the soil factor has been correct in many of the orchards of southeastern United States, production per tree is low. According to the Alabama Experimental Station Bulletin, one chief cause of low yield is that trees have been planted too close together. As they grow larger, competition for inadequate water, light, and plant food, "is responsible for lower yields and eventual stagnation of such trees."

Planting

The practice has been to plant trees from 40 to 60 feet apart, thus giving approximately 17–27 trees per acre. Decrease in yield, which usually comes after the twenty-fifth year cannot be

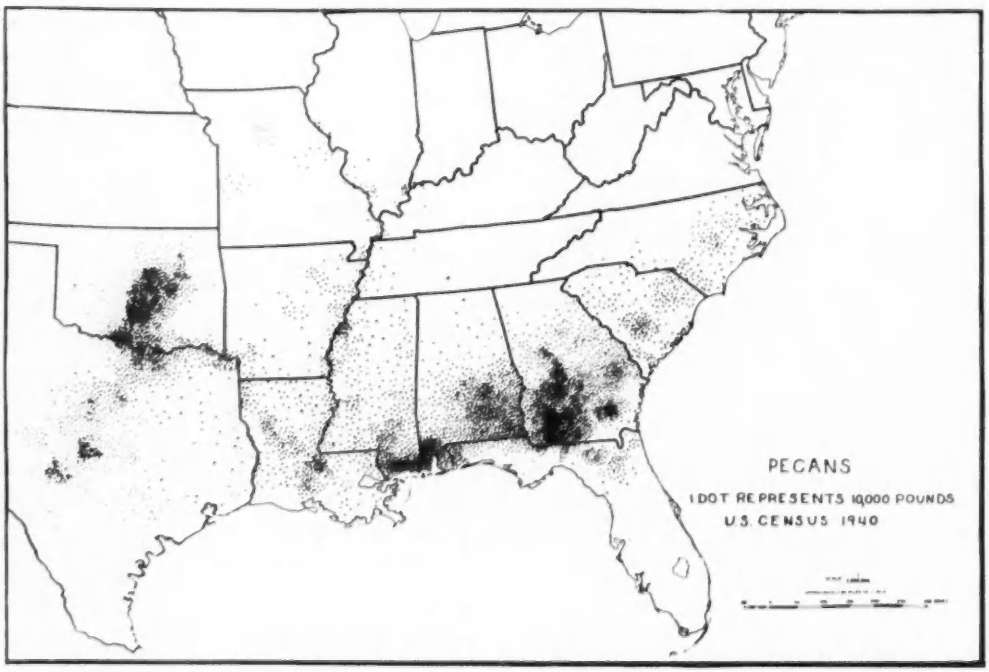


FIGURE 3.—Distribution and density of pecan growing in the United States, 1940.

due to old age alone for many old, isolated trees are known to be high producers, yielding up to 700 pounds per tree per year over a period of twenty-five years. Upon such basis, experiment station workers have concluded that in new orchards trees should be spaced at 70, 80, or 100 feet giving approximately nine, six, or four trees per acre and that trees in old orchards should be correspondingly thinned. However, "reducing stand does not obviate need of applying fertilizers, of growing cover crops, and of adequate cultivation."

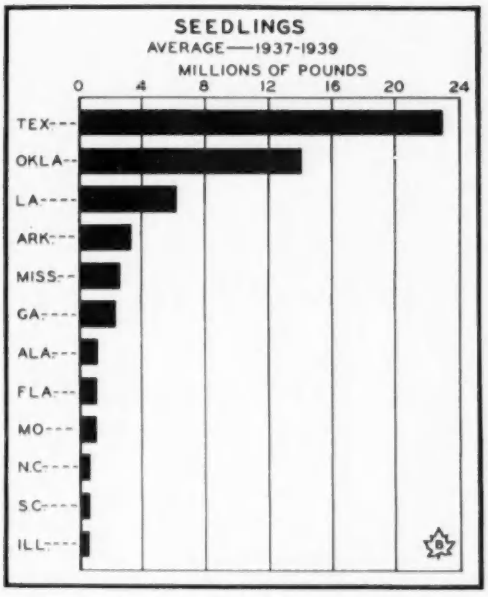


FIGURE 4.—Pecan seedling production average for 1937–39.

Commercial Varieties

Among the most common varieties planted, Stuart and Schley are best known to the pecan trade. Both varieties are popular because of their rich-flavored, well-filled kernel and comparatively thin shell. They have been very popular with planters also, although the Schley has fallen somewhat into disfavor in recent years as it is very susceptible to scab. Other common varieties are Success, Moore, Van Demen, Teche, and Brooke. Although hundreds of varieties have been developed, no ideal variety has been found. Planters and experiment station workers are still searching for a variety which is productive over wide range of climatic conditions, is disease resistant, and has inherently good filling and cracking qualities. Development of a nut meeting these demands may be one of the several factors upon which future success of the pecan industry will rest.

Propagation

The will of man to improve products upon which his social, cultural, and economic status depends has brought about improvement of many native plants, like the paper-shell pecan, which has been evolved through grafting from a small, hard-shelled, bitter seedling to the large, thin-shelled, delicately flavored fruit which sells freely on the market today. Such improved varieties do not reproduce true to seed, and must be propagated by grafting, budding, or top-working.

Most pecan orchardists prefer budded to grafted trees, especially where abrupt changes in temperature may result in freezing or winter injury. Grafted trees are worked at ground level or below and are more susceptible to this type of injury, whereas budded trees are worked a foot or more above ground where winter injury seldom happens. In fact, many planters refuse to buy grafted trees for this reason.

Top-working is the most inexpensive and quickest way of bringing trees into bearing. With trees of proper size, it is possible to have new tops come into bearing during the second or third year. For the best results, young trees not over 40 feet high or 30 years of age can be top-worked profitably. If the

tree is too large, shock may cause its death; therefore whenever possible, top-working should be done on the branches rather than on the trunk, leaving a few small branches to minimize shock to the tree. All neighbor trees should be moved to a distance of 60 feet so that overcrowding will not result in low yield.

By such methods of budding, grafting, and top-working, trees which are partially or even wholly non-productive may become valuable assets, and go a long way toward making the farmer's orchard a success.

Fertilization

Since pecan production has become an important industry in the South, numerous plantings have been made on soils lacking fertility or on soils which lack inherent ability to maintain the fertility they have. In most areas fertility of soils to which pecan trees are indigenous is maintained by silts and muds deposited by periodic overflow of adjacent streams. Since the pecan is a heavy feeder and depletes soil quickly of its plant food, a program of constant soil improvement must be followed in areas where no fertilizing muds and silts are carried in naturally. Practically all soils of the southeastern pecan belt require soil enrichment practices, which may be accomplished in two ways: (1) by the use of commercial fertilizers and, (2) by means of a cover crop program. At the same time, the two procedures help to conserve moisture and aid in the control of diseases. Suitable fertilizers for use in the pecan orchard are mixtures of nitrogen, potash, and phosphates, supplemented by compost and stable manure. That such fertilizers are even more effective when used with a cover crop program has been proven by scientific experimentation.

Selection of the cover crop depends on locality, prevalence of disease, type of pecan tree, and native condition of the soil. A few preferred crops used are velvet beans, crotelaria, runner peanuts, Austrian winter peas, crimson clover, and small grains; all except grains are legumes which add nitrogen. Commercial intercrops are found profitable in non-bearing orchards; but not so in bearing orchards, as grain crops and vegetables are likely to compete with the trees for plant food and moisture, and many are hosts to harmful insects.

Disease and Insect Pests

High temperature and humidity, which prevail in southeastern United States, favor growth of pecan trees and

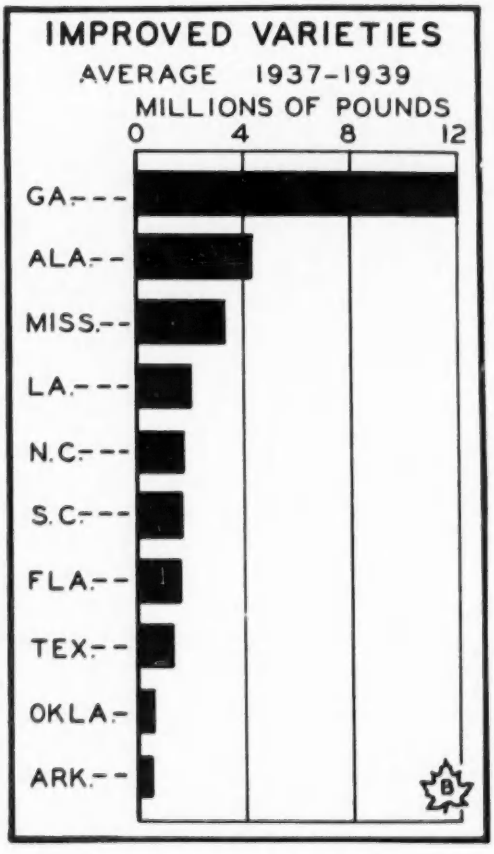


FIGURE 5.—Production of improved varieties of pecans. Average for 1937–39.

production of nuts, but also contribute to coexistence of certain diseases, insect pests, fungous growths, and other injuries to the pecan tree. Chief among destroyers of pecan trees is the fungous disease called scab. In the past it has been controlled by top-working and spraying. However, formerly used spray programs have proved inadequate, and top-working varieties thought to be more resistant to the disease have failed. Therefore experiment station

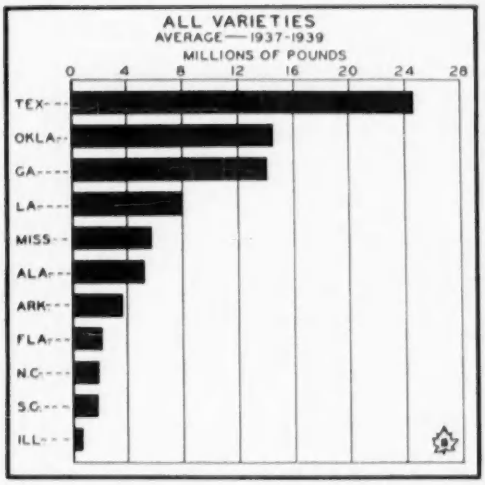


FIGURE 6.—Average production of all varieties of pecans, 1937–39.

workers are now seeking some new spray to check the disease without injury to foliage, buds, and young nuts. None has yet been found that will wholly eliminate the disease.

Winter injury, caused by sudden temperature changes, and wood rot, resulting from bruises made by hail, windstorms, or injury made in pruning or top-working, are injurious to pecan trees, although not comparable to scab in their destructiveness. Wrapping tree trunks with heavy cloth and planting cover crops to check tree growth during late fall and winter help eliminate winter injury. Painting with coal-tar-creosote aids in control of wood rot.

In addition to diseases there are hundreds of destructive insects which attack pecan trees; among them, shuckworm, pecan leaf case-bearer, pecan nut case-bearer, and black pecan aphis are most widespread and destructive as they are found in practically all pecan producing areas. All insects except the shuck worm can be fairly well controlled by an adequate spray program. Since a satisfactory spray program has not as yet been developed for control of the insect, the best method for its destruction consists of covering the nuts which drop from the trees with earth to prevent the moths from emerging, and later disposal by burning.

Thus, in control of both disease and insect pests eternal vigilance is the price of success. In southeastern United States, where climate favors development of fungi, insects, and other types of injury, expenditure of both time and money is great but necessary if pecan orchards are to be profitable.

Harvesting

Early maturing varieties of pecans are usually ready for harvest about the last of September. Since all nuts on one tree do not open at the same time, trees are usually gone over twice. Thus the second crop of the early maturing varieties may not be completely gathered until December or even later, along with later maturing varieties. Best quality nuts are those that fall to the ground with the wind, but ordinarily they are harvested as soon as the shucks open wide and the shells have gained full color. When nuts can be easily knocked from the husks they are jarred, shaken, or beaten from the trees. Bamboo poles are used to thresh the ends of branches; but care must be taken that small buds and twigs that produce next year's crop are not damaged. Canvas sheets placed on the

ground to catch the nuts as they fall expedite gathering. After the nuts have fallen on the sheets, the corners of the sheet are gathered and the sheets turned upside down; the nuts fall into piles, and the sheets are spread under the next tree. Nuts can then be picked from the piles, leaves and shucks destroyed to eliminate scab and shuckworm, preliminary grading done, and good nuts taken from the orchard. Any that are not dry are placed on trays of fine chicken wire or hardware cloth for a few days. When they are thoroughly dry, they are graded and bagged for sale.

FIGURE 7.—Pecan orchard near grower's residence, a common scene near the Gulf Coast.

Shelling and Cracking

San Antonio has been the center of the shelling industry for more than fifty years. About half the nation's seedling pecans were shelled there each year between the years of 1930 and 1940. The reasons for growth of the industry in this particular city are twofold: first, the large available supply of Mexican labor, and second, pioneer efforts of San Antonio business men to establish the shelling industry in their own community. St. Louis has also been important as a processing center. No reason has been found for this city's importance as such, but it seems altogether reasonable to assume that location of the city, its easy accessibility to states producing improved varieties of pecans, and its further importance as distributing center may be partial explanation.

Analysis of earnings of pecan shellers in 1938 indicated that they formed one of the lowest paid groups of industrial workers in the United States, the average family income being $251 for 4.6 persons. A migratory work problem has resulted from prevalent low wages in the region. Many Mexicans move into southern, central, and western Texas in summer for cotton picking, and others go as far as Michigan and Minnesota to sugar beet fields to supplement their income, returning to Texas for the pecan harvest.

Marketing Procedures

Pecans are marketed the year round, although there is a greater retail trade during fall and winter months, 70 to 85 per cent of unshelled pecans being sold during November and December. Usually the current crop cannot be placed on the market in volume until after November first, because of late harvesting and processing practices. In years of heavy production large percentage of the crop is carried over in cold storage and marketed the following season.

In marketing nuts, improved and seedling varieties are handled in differ-

ent ways. Improved varieties are distributed largely unshelled to consumers, as they are large and easily cracked; whereas the major portion of the seedling crop is sold to commercial shellers. Most of the sales of improved varieties takes place through large shippers such as the National Pecan Marketing Association or to local buyers. However, some growers consign their crop to a city dealer or retailer, or sell directly to the consumer, shipping the nuts by parcel post.

The seedling crop is ordinarily assembled through county dealers, merchants, and representatives of shellers, who buy the nuts ungraded. A major portion is then shipped to San Antonio where the nuts are graded, cracked, and the meats extracted before being marketed. On an average, only 38 per cent of the seedling, by weight, is meat; and it is cheaper to ship the meats to market from San Antonio than to ship unshelled nuts to other cities to be shelled.

Use and disposal of the pecan crop varies in different states depending upon degree of concentration of the industry. Percentage of local consumption varies from one twentieth in Georgia, Florida, and Louisiana, to one fourth in the Carolinas, where large quantities are consumed on the farms where they are grown.

Ordinarily improved varieties sell from two to three times the price of seedlings, although some larger good-quality seedlings command as high price as improved varieties. New York, Cincinnati, Chicago, and St. Louis are among chief distributing centers for pecans.

USES OF PECANS

Commercially shelled pecans are used in part by confectioners, bakers, ice cream manufacturers, and salters, and the rest are retailed directly to the consumer. Unshelled varieties are more popular with the average consumer, amounting to about two-thirds the entire sale, probably because unshelled nuts are much cheaper; since they are large and thin shelled, they can be quickly and easily prepared for use by the housewife. Many people do not realize that the high concentration of proteins and fats in the pecan make it an energy producing food. Pecans can be substituted for meat, eggs, fish, or cheese. Furthermore its proven vitamin A and B content should lead to its increased use as a food.

In addition to value of the nut, wood of the pecan tree is strong, tough, heavy, and hard, and can be used commercially. Although difficult to process, it can be finished to resemble walnut or mahogany. It has long been used for vehicle parts, tool and implement handles, and ladder rungs. More recently it has been used successfully for furniture and interior trim. No case has been found where the pecan is used for its oil, as many other nuts are used today, probably because its high price as compared to other oil producing seeds, prohibits.

The question has been raised as to the stability of the pecan industry and the probability of its survival. The answer lies largely in price, and quantity and quality of nuts produced by the orchardist. Current high prices may change considerably after the war, and a precipitous drop might spell disaster to the producer whose expenses are high in maintaining a highly productive orchard. However, if he can produce enough nuts of fine quality to go on the market at reasonably good prices, pecan production should become one of the stable industries in southeastern United States.

BOOK REVIEWS

TREWARTHA, GLENN THOMAS. *Japan; A Physical, Cultural, and Regional Geography.* xv and 607 pp. The University of Wisconsin Press, 1945. $5.00.

"Japan; A Physical, Cultural, and Regional Geography" is a noteworthy book; noteworthy in its complete and exhaustive text, noteworthy in its excellent illustrative material of maps, charts, diagrams and graphs, and their number, noteworthy in its literary craftsmanship, for clarity, unity, and interpretation, and noteworthy in its format and its physical makeup. It is one of the most complete and authoritative treatises available for any part of the world. It is opportune, valuable, and indispensable for the solution of the problems of the hour. It is all of these things because the author is one of the foremost geographers of our period; because he is personally and thoroughly acquainted with the land of which he writes; because he is a master of expository style, meticulous in the organization of his material, discriminating in his choice of words, and thoughtful of the needs and qualifications of his readers.

The layman as well as the geographer and the student of geography and its related fields, will find this geographic treatise of Japan wholly satisfactory. It is rich in factual material, sound in its principles. It is easy and pleasant to read. It is richly and pertinently illustrated. The paper and the type are superior in quality and appearance. Adequate and satisfactory references are provided for every chapter. Particularly valuable are the numerous maps which portray graphically the significant elements in the text and in the land and life of Japan. If there are any errors, they are so trivial in comparison with the general excellence and broad scope of the volume, that they can be readily ignored, and should be.

Trewartha's "Japan" deserves the best that can be said about a text and reference book. It is a monograph on a great land and people. It is a book that should be in every up-to-date Library. It will prove an outstanding text for class room purposes, and reference for all kinds of occasions.

W. E. E.

VAN CLEEF, EUGENE. *Getting into Foreign Trade.* viii and 133 pp. The Ronald Press, New York, 1946. $2.50.

A sensible and practical guide to owners and managers of business enterprises "who wish to expand the domestic activities of their businesses to include foreign sales" and citizens planning "to follow foreign trade as a career, either in the business world or in government service," Van Cleef's new and able volume comes as indispensable introduction to a great field of human activity and sound statement of principles and methods by which foreign trade is conducted. In a way, it is a new approach to an old subject, made more interesting than it has ever been considered before.

The book attends strictly to its subject. It is carefully organized, clearly and effectively presented, and limited to the essential facts and principles involved. The author is well known for the clarity and succinctness of his style. He has already made numerous important contributions to geographical literature. He has become one of the leaders in the field of Economic Geography, a specialist in some of its more important phases. He has applied to this book the same careful principles of presentation that have distinguished his earlier works, and in some ways improved upon them. He has long been associated with the foreign trade field, and it is from his personal experience in it, and participation in numerous committees and conventions that he draws many of his conclusions. The book is eminently practical, definitely not merely theoretical or philosophical. It can be used as text, as introduction to the subject of which it treats, and equally well as reference.

It is printed in clear type, on good paper. It is bound well. It serves well its purpose. The author has rendered our American business world and our American geographical field a valuable service in composing and presenting this book.

W. E. E.

HONIG, PIETER, AND VERDOORN, FRANS. *Science and Scientists in the Netherlands Indies.* xxiii and 491 pp. Board for the Netherlands Indies, Surinam and Curaçao, New York, 1945. $4.00.

This monographic volume presents the following material:

1) Original articles, prepared especially for this volume, dealing with the development or status of various branches of science in the Netherlands Indies.

2) Reprints of similar accounts previously published elsewhere, several of which originally

appeared in Dutch and are now being made available in English.

3) A number of travel accounts and impressions by distinguished visitors in the past, often offering delightful glimpses (scientific and otherwise) of life and nature in the Netherlands Indies.

4) A number of shorter articles—notes, biographical sketches, reviews, etc. ("Serta Malesiana")—comprising material often of interest from the viewpoint of the promotion of North America—Netherlands Indies relationships.

5) A list of scientific institutions, societies, and workers in the Netherlands Indies at the time of the Japanese invasion.

Some thirty-odd authors have contributed material to the volume, many of them well known in America, and a goodly number throughout the world, thus vouching for the authoritativeness of the material presented, which constitutes almost a compendium of information regarding the subjects treated. It is a most valuable reference work that should have a place in every major Library in our country. It will remain for many years the standard source book of material on the regions of which it treats.

It is well bound, richly illustrated. It contains a wealth of significant information, all carefully organized and integrated.

W. E. E.